GENERAL ELECTRIC

1978 Annual Report

AR26

GE Board Committees— one key way to assure ‘corporate governance’

Nominating Committee
Assessing Director candidates and Committee memberships

Operations Committee
The Board’s monitor of GE operating performance

Technology and Science Committee
Seeking the greatest potential from GE research and development

Management Development and Compensation Committee
Maintaining the quality of General Electric managerial leadership

Public Issues Committee
Assuring a thoughtful GE voice on key issues

Finance Committee
Appraisal of General Electric financial planning

Audit Committee
Independent assessments of audits of General Electric

GE 1978 Annual Report

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The cover:
"Corporate governance," a term that is appearing more often in public debate, encompasses a number of issues concerning the accountability of business managers for the effects that their actions and decisions have on customers, share owners, employees and the general public. The main point at issue is whether business enterprises can themselves provide responsible corporate governance or must submit to further Government intervention and regulation. On pages 4-5 of this Annual Report, GE's Chairman presents the case for business-initiated measures to tighten controls and disciplines, including steps now being taken to make corporate boards of directors more effective. As a case in point, the front cover illustrates how, beginning in 1972, GE Directors have organized seven Committees of the Board, each of which monitors a major area of GE's performance.

Note: Unless otherwise indicated by the context, the terms "GE", "General Electric" and "Company" are used on the basis of consolidation described on page 36. Unless otherwise indicated by the context, the terms "Utah" and "Utah International" mean Utah International Inc., as well as all of its "affiliates" and "associated companies" as those terms are used on page 36.

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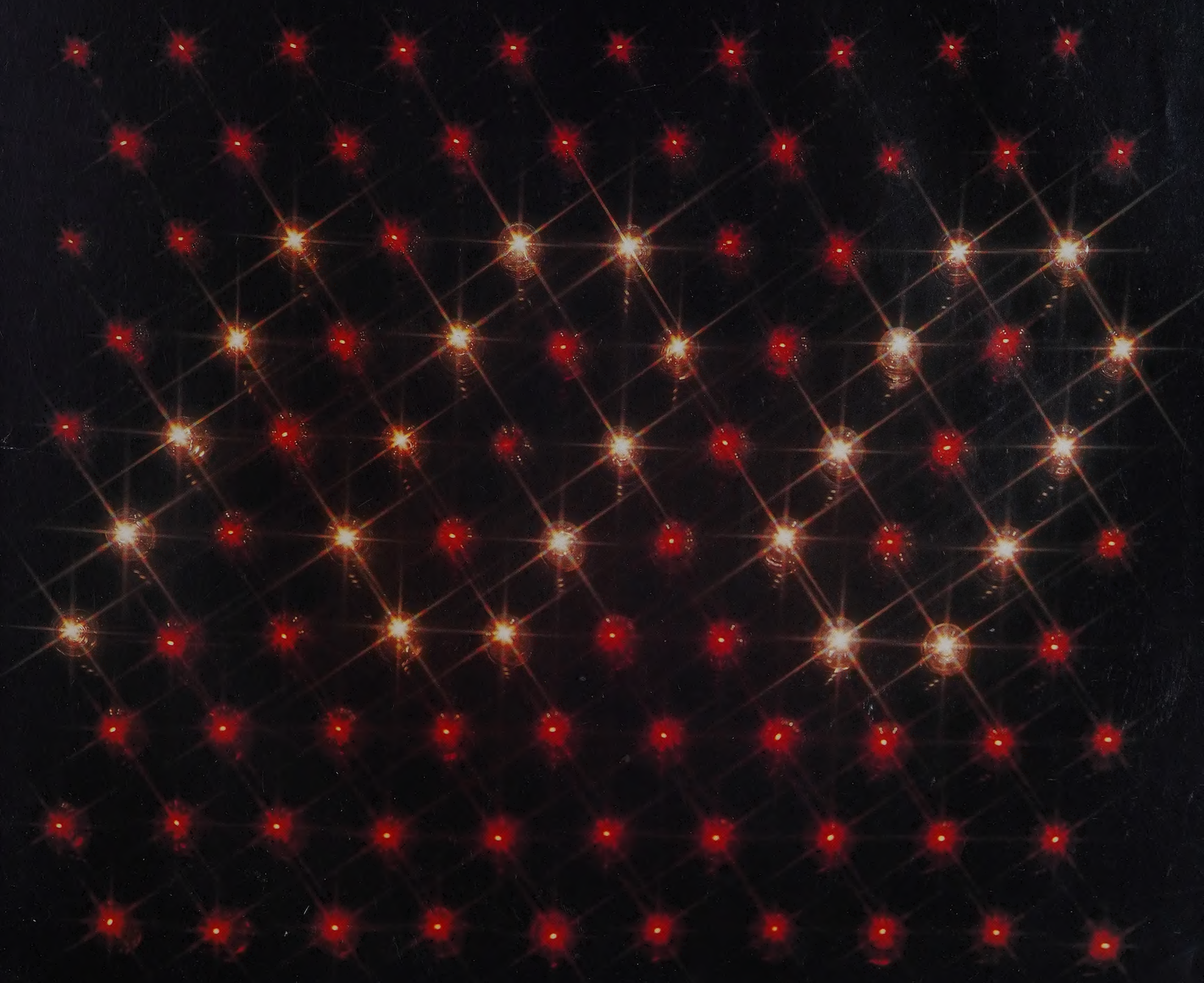
GENERAL ELECTRIC

INVESTOR

Special centennial issue—Fall 1978

AR26

Foundation for growth:
100 years of
General Electric technology



Viewpoint

GE technology's first century: a case history with meaning for the future

In keeping with the celebration of your Company's Centennial Year, this special edition of the GE *Investor* tells the story of 100 years of General Electric technology. To us as share owners, it's interesting to note that the story begins with an investment — the $50,000 that a group of investors raised in 1878 to underwrite the Edison Electric Light Company in its work on the incandescent light.

Dr. Arthur M. Bueche, left, Senior Vice President — Corporate Technology, and Board Chairman Reginald H. Jones inspect one of many exhibits depicting GE technological achievements at the GE Centennial Hall of History exhibition in the Schenectady Museum.

Front cover: *General Electric's Centennial "birthday cake" is lighted by the life-saving glow of tiny new halogen lamps developed to aid doctors and surgeons by providing light inside the human body.*

The account also documents General Electric's deep and abiding commitment to research and development. Your Company pioneered industrial research by establishing its Research Laboratory in 1900, adding the dimension of pure scientific exploration to its already existing engineering laboratory. The resulting flow of new discoveries and innovations has helped shape General Electric into the strong technological enterprise it is today.

For investors, a special relevance

The close correlation between General Electric's technological leadership and your interests as share owners has been borne out anew by an important Company-wide study completed this year. This analysis, which we call the Corporate Technology Study, was conducted specifically to appraise the present status of technology in General Electric, comparing it to foreign and domestic competition as well as to our own historical position. The study demonstrates the importance of technology to General Electric's financial results. One finding shows, for example, that among the business components studied, those with leading or upward-trending technical strengths are the most profitable and have achieved the best income growth over the past five years.

We look to this thoroughgoing analysis to provide a guide for our efforts to maintain General Electric's technological momentum into the future and to serve as a catalyst for new technical initiatives. Already, many of the proposals growing out of the study are being carried through to improve our recruiting and development programs for technical people, to provide new managerial training opportunities for experienced technologists moving into management positions, and to strengthen our whole approach to the nurturing of scientific and engineering achievement.

General Electric is, thus, a Company with deep technological roots and with a comprehensive program for maintaining and strengthening its technical resources in the future.

A synthesis of talents

To concentrate on the Company's technology in so short a space means that other significant elements of the General Electric story must inevitably be slighted. Only passing reference is made here, as an example, to the continuity of sound management that has played so large a part in your Company's success. Since the Company's formation under its present name in 1892, when Edison General Electric merged with Thomson-Houston, General Electric has operated profitably in every year, and has a record of uninterrupted dividends extending back to July of 1899.

In the years from 1895 to 1977, sales grew from $12 million to over $17 *billion* — well over a thousandfold increase. Earnings, too, have increased better than a thousandfold, from about half a million

dollars in 1895 to more than a billion dollars in 1977. That represents a doubling of sales and earnings, on the average, about every eight years.

Financial integrity is another cornerstone of the Company's century of success. Prudent accounting has long been a GE tradition — a fact that is reflected in the Company's AAA credit rating. Sound financial practices have made possible the capital required to grow new businesses, revitalize existing ones and install the plant and equipment needed to maintain a competitive company.

To achieve this record of performance, then, has required creative contributions not only from technologists but from strong leaders in all the other disciplines vital to business success. It is on the basis of this great synthesis of talents that we can claim without its being an undue boast or an empty slogan that General Electric has contributed 100 years of progress for people.

Two larger meanings

In the adversary climate that characterizes much of American life today, however, this story of one company's technological experience takes on two larger meanings that deserve at least brief comment.

For one, the General Electric record challenges the "anti-technologists" who are trying to cast technology as a negative force, producing more harm than good. In the face of the myriad GE advances that have been of direct social benefit — from the tiny surgical lamps on this *Investor's* cover to the concluding example of the heat pump that is helping to conserve energy — it seems strange to have to defend the results of technology. But by selecting small parts of the vast whole of this country's technological performance, the critics seek to persuade the public to regard technology and technologists as despoilers of the quality of life and as root causes of many of today's social ills.

With this issue, as with others in the public debate, the best antidote is to weigh the charges against the overall record. When this is done, it seems clear to us at General Electric that the anti-technologists have reached their position only by ignoring the overwhelming balance of benefits that flow from technology.

In our view, the real results from technology are more jobs for U.S. workers, increased productivity, contributions toward a more favorable balance of trade, greater resistance to price inflation — and the improvements in the quality of life that these economic advances make possible. The positive consequences of technology are borne out by a number of studies. A recent study by Data Resources Inc., as an example, compares the performance of high-technology companies with low-technology businesses. The study shows that high-technology industries have grown almost three times as fast, increased their productivity twice as fast, and expanded their employment nine times as fast, while at the same time raising their prices only one-sixth as much as low-technology industries. Moreover, the high-technology companies quadrupled their trade balance surpluses, while low-technology companies helped to deepen the U.S. trade balance deficit.

Needed: more, not less, technology

Our second general observation grows out of these findings about U.S. research and development. And it is that this country needs more technology, not less.

Your Company has repeatedly called public attention to our country's diminishing technological leadership. We have pointed out that at a time when other leading industrial nations have been increasing the percentage of their gross national product invested in R&D, the U.S. percentage has been decreasing.

What can be done to halt this erosion of U.S. technology? Our recommendation is most direct: improve the overall U.S. investment climate. Research and development expenditures are investments in "knowledge capital" and are, consequently, subject to the same forces that encourage or impede capital formation in general. For business managers to risk funds on research, they must have long-term hopes of return similar to those that influence decision-making on investments in other forms of capital.

And, as we have stressed in other reports to General Electric share owners, the lack of incentives for capital formation is a basic weakness in the current U.S. economic game plan. Uncertainties about tax policies, plus inflation and the mounting cost burden of governmental regulatory demands, can only increase risk levels to the point where the business manager cannot, in the interests of his share owners, make needed investments, whether these are in new production equipment or new research projects.

It comes down to this: technology in the United States is in urgent need of revitalization. The trends that have been dulling the competitive edge of U.S. technological leadership must be reversed. The great spirit of discovery, so evident in the story of General Electric, needs to be rekindled on a national level. Then this country can get back on the technological high road that leads to increased social benefits for the American people, more jobs for the work force, and a stronger drive for U.S. businesses competing in world trade.

Reginald H. Jones

Chairman of the Board

1. The beginning: Thomas Edison and lighting technology

by Alex Groner

Only 100 years ago, people commonly illuminated the darkness by the flickering light of flame. Campfires had given way to sputtering torches, and these in turn to oil lamps and candles. Finally, the most efficient lighting came from controlled gas flames, use of which expanded rapidly after 1850, in spite of obvious fire and health hazards.

The search continued, however, for still better light sources, and what fired the imaginations of scientists and inventors was the untapped potential of the mysterious new force of electricity following the discovery in the 1830s that a combination of magnetism and motion could produce an electric current.

Subsequent development of dynamos — and of the first commercially successful generator, in 1872 — made possible steady and reliable electric current, leading to widespread experimentation with electric arcs and arc lighting. An arc lamp was on display at the Philadelphia Centennial Exposition in 1876, and by 1877 Charles Brush of Cleveland had an arc-lighting system on the market.

Edison's insight

The arc light, essentially a continuous spark impelled by an electric current to bridge the gap between two electrodes, gave off a brilliant light — too brilliant for use anywhere but in outdoor or very large indoor areas.

Among the researchers looking for ways to "subdivide" this light into units small enough for use in homes and shops was Thomas Alva Edison, with a reputation already established as the inventor of the telephone transmitter and the phonograph, both in 1877.

Focusing on incandescence — the use of electricity to create a glow in an "ember" of some still indeterminate material — as a way to "subdivide" the arc light's glare, Edison searched for a filament material that could withstand the strains of high heat, as well as ordinary handling in production and use.

Knowing that the filament material would have to offer high electrical resistance in order to be brought to a high enough temperature to give off appreciable light from a small amount of power, and that resistance increased as the cross-section of a conductor grew smaller, he realized that what was required was a hair-thin filament. So while others continued to work with heavier elements, Edison looked for a material that would be rugged even when drawn gossamer-thin.

Needing more funds to continue his research and development work, Edison turned to a close friend, Grosvenor P. Lowrey, who had no difficulty in persuading a number of large investors to back the young inventor's project. The Edison Electric Light Company — predecessor of General Electric — was incorporated on October 17, 1878.

A loop of thread

During the following year, Edison's laboratory successfully produced a vacuum pump that evacuated

Alex Groner has spent most of his career in journalism — as a newspaper reporter, newsmagazine correspondent, freelance writer and editor. He is the author of "The History of American Business and Industry," published by American Heritage, and "Going Metric," published by the American Management Association; he is also co-author of "Science in the Service of Mankind," published by Heath.

Edison's first practical incandescent lamp proved itself in a 40-hour test ending October 21, 1879, and began GE lighting progress that today includes modern high-efficiency outdoor systems for cities such as Washington, D.C. (opposite page).

all but one-millionth part of an atmosphere from a glass bulb. And after experiments were conducted with the carbonization of hundreds of different materials as possible lamp filaments, a loop of ordinary sewing thread was carbonized and placed into the electrical circuit of a lamp.

On October 19, 1879, the power was turned on; the thread glowed red, then white, and maintained a steady brightness for over 40 hours before the experiment was concluded. A patent was applied for on November 4 and was granted three months later.

But work began immediately to find an even better filament. As Edison described it: "One day I happened to see a palm leaf fan on one of the tables. I picked it up and found that it had on its rim a very long strip of bamboo . . . we soon had this cut up into filament lengths and carbonized. On putting these filaments into lamps, I was gratified to find that the lamps were very much better than any we had previously tried." After testing more than 6000 varieties of vegetable fiber, he discovered a Japanese bamboo to be superior, and arranged for regular supplies.

By 1880, the lamps, rated to last for 600 hours, were being produced in a new factory. Their first commercial use was on the steamship *Columbia*, which boasted 115 of the electric lights on her maiden voyage from New York City to San Francisco in May 1880.

The GEM lamp

In 1889, the Edison Electric Light Company merged with several other firms to form the Edison General Electric Company, and three years later Edison General Electric and the Thomson-Houston Company combined to form the General Electric Company, on April 15, 1892.

That same year, the new Company employed a young engineer, Charles Proteus Steinmetz, who housed a brilliant mind in his short, hunchbacked body. Among his many contributions was his role, several years later, in helping to start the General Electric Research Laboratory under the direction of Dr. Willis R. Whitney.

Dr. Whitney, working on the problem of the blackening of light bulbs during use because of evaporation of carbon from the filament, discovered that if lamp filaments were metallized and heated to 3500 degrees Centigrade in an electric-resistance furnace, they became tougher and harder, developed higher electrical resistance, and gave off more light. The result was a new lamp called the GEM — an acronym for "General Electric metallized" — which went on the market in 1905 and was sold for a dozen years.

Taming tungsten as a filament

Meanwhile, research continued in Europe on the use of metals as lamp filaments, with tungsten being especially promising because of its ability to withstand high temperatures; it was, however, considered too brittle to be of use in lighting applications.

Dr. William D. Coolidge, who had joined the GE Laboratory in 1905, began working with tungsten in 1906, and after more than two years succeeded in producing ductile tungsten which had lost most of its brittleness and could be bent when it had cooled. By 1910, General Electric was able to announce that Dr. Coolidge had succeeded in making ductile tungsten on a commercial basis. The tungsten filaments were strong enough to withstand the vibration and jolting of lamps in vehicles such as streetcars, and their efficiency was vastly greater than that of Edison's carbon filaments.

The gas-filled lamp

The next major advance in lamp development was the work of Dr. Irving Langmuir, a young scientist at the General Electric Laboratory. Studying the

Worldwide spread of electrical technology is symbolized by Edison statue in Osaka, Japan.

The pioneers: Thomas Alva Edison

Thomas Edison is everyone's idea of the inventor. Dreamer, drifter, tinkerer and tireless experimenter, he had an uncommon feel for the way things would or should work. His imagination led to grand conceptions; his razor-sharp mind worked out ways to execute them and to anticipate problems that might arise; his fine hand and eye and, most important, his indefatigable persistence, led him to solutions he could not foresee.

He abhorred school — and spent no more than three months there — but he was enthralled by learning. His mother instilled in him a great love for great works of literature and history.

Deaf from the age of 12, he overcame that handicap and as a youth became an itinerant railroad telegrapher. He moved from job to job, but his agile mind was unsuited to humdrum work. He found his more appropriate vocation when he got his first patent at the age of 22 — for an electric vote-recording machine, a device he was unable to market. But it opened the floodgates of a career in which he was granted more than 100 patents, and which included such major achievements as quadruplex telegraphy, the phonograph, the microphone, the incandescent lamp, an alkaline storage battery, and talking motion pictures. When the General Electric Company was organized in 1892, he was on its first board of directors.

Had he wished, he might have become an important corporate executive, or an entrepreneur amassing great fortunes. Instead, he chose to remain in his laboratory, exploring nature's secrets, and there found wealth of another and perhaps more enduring kind.

problem of light bulbs blackening in use because of the evaporation of the filament, even in a vacuum, Langmuir deliberately "spoiled the vacuum" by introducing inert gases into the bulb. He tried a number of gases and found that argon was the most satisfactory.

General Electric introduced gas-filled lamps to the market in 1913. The first such lamps were in 750-watt and 1000-watt sizes. The 100-watt gas-filled lamp was introduced in 1917, with a 25-percent increase in efficiency over earlier vacuum bulbs.

Fluorescent lighting introduced

Further developments in lighting were made both by the GE Research Laboratory and by the Lighting Research Laboratory of the National Electric Light Association (originally under the sponsorship and later the ownership of General Electric) at Nela Park in Cleveland, Ohio. Among the advances that were quickly and widely adopted were the inside exhausting of the light bulb, thus eliminating the sharp and dangerous glass tip; frosting of the inside of the light bulb to cut down glare without weakening the bulb; introduction of the first U.S. photoflash bulb; and development of sealed-beam automobile headlamps to lengthen lamp life and maintain an almost uniform level of light output.

GE lamp pioneers George Inman, left, and Richard Thayer, right, did early research that resulted in GE announcement in 1938 of commercial fluorescent lamps. Continuing research is producing more efficient fluorescent lamps such as the energy-saving Watt-Miser® line.

But the principal lighting advance of this period came with fluorescent tubes. The idea was an old one — having gases carry a current between electrodes in a long tube whose inside surface was coated with phosphorescent materials that converted ultraviolet into visible light — but it had not taken the form of much more than a laboratory curiosity. Edison had built one such lamp; a GE employee named D. M. Moore had worked with tube lights as far back as the 1890s. The lamps were highly efficient, but costly and complicated; and they required very high voltages.

What principally spurred GE research in fluorescence was a letter from Dr. Arthur H. Compton, the Nobel Prize winner, in 1934. Dr. Compton, who was then a technical consultant for General Electric, wrote about a tube lamp with fluorescent material that he had seen in England, citing it as an interesting field for exploration.

Nela Park researchers began gathering data from research work that had been done all over the world, seeking to tie various loose ends together. A small experimental tube lamp provided encouraging results, and batches of hundreds of different materials were made up and tested for fluorescence.

Samples of fluorescent lamps were first displayed in 1935, at a meeting with Navy officers and later at a convention of the Illuminating Engineering Society.

In 1936, at a dinner to celebrate the centennial year of the U.S. Patent Office, General Electric fluorescents provided most of the lighting in the large hall. The lamps were shown at the New York World's Fair and at the San Francisco Golden Gate Exposition in 1938 — and they were placed on the retail market that same year.

George E. Inman, who had directed the project at GE's Lamp Development Laboratory, was granted a patent for the basic design principles of a practical fluorescent lamp in 1941.

Lucalox — lighting's 'Third Age'

One of the surprising results of research is how seemingly outmoded ideas can, with new insights, stage a resurgence. So it has been, in recent years, with arc lights.

General Electric had been involved in arc lighting from the time of its merger with the Thomson-Houston Company. Steinmetz had a major responsibility in the development of the highly efficient

magnetite arc, and carbon-arc lamps continued to make up a substantial portion of the electric lighting market until around 1910.

Never completely fading away, arc lamps returned to become a major factor in lighting about 1950, with development of the high-pressure mercury arc lamp in Europe.

The next important step was a result not of lighting research but of *basic* research work, in the field of ceramics, at the General Electric Research Laboratory.

Under the guidance of the Laboratory's director, Dr. C. Guy Suits, a group of researchers headed by Dr. Joseph E. Burke began an expanded study of the nature and properties of ceramics in 1954. Their first experiments resulted in a way to make aluminum oxide, commonly known as alumina and normally an opaque white ceramic, translucent through use of a sintering process.

Nela Park's Dr. Inman, who saw samples of the translucent material, pointed out that if it could be made more translucent, or even transparent, it might be better than fused quartz in high-temperature lamps, since it could withstand greater heat.

At the Research Laboratory, Dr. Robert L. Coble found that by adding other materials, such as magnesium oxide, to the alumina powder before sintering he could produce alumina that was more nearly transparent than he had thought possible.

There were, of course, other problems to be solved, such as learning how to fuse an electrode to alumina and determining the proper gas to be vaporized under pressure.

The ultimate result was a sodium arc in a highly translucent alumina envelope — a lamp that could withstand temperatures more than 300 degrees Centigrade higher than was possible with a high-pressure mercury arc lamp. Christened Lucalox®, the new lamp went on the market in 1965, ushering in what General Electric called the "Third Age of Light," as important as the incandescent and fluorescent developments that had preceded it.

Now celebrating their thirteenth anniversary, Lucalox lamps are recognized worldwide for their efficiency and economy. They are being used in industrial applications, where they help to increase

"Miss Liberty" stands proudly above New York harbor, her torch aglow with energy-efficient GE Lucalox® lamps and her crown illuminated with GE clear mercury lamps. Research into new lighting (opposite) strives for more light output from less energy input.

production, improve morale and curtail accidents. They are floodlighting buildings and monuments. They are illuminating playgrounds, beaches and parks. They are providing the light in many schoolrooms. And by brightly lighting up streets and highways in many of the world's great cities, they are helping to reduce crime and auto accidents and make downtown urban areas safer and more attractive after dark.

Significantly, the development of Lucalox lamps provides a clear demonstration of the happy marriage that is possible between pure scientific research and the practical application of the results of such research.

Today and tomorrow

General Electric's lamp business has come a long way since Edison's first carbon-filament bulb glowed so brightly in 1879. Today's GE lamp catalogs list literally thousands of different lamps — from the tiniest bulbs designed for use in highly sophisticated surgical procedures up to a 10,000-watt lamp for motion picture studio applications. There are all types and sizes of incandescent, high intensity discharge, and fluorescent lamps — including a recently introduced plug-in fluorescent for residential use. There are Christmas tree and other miniature decorative lights, floodlights and spotlights, and photoflash bulbs to complement the newest cameras.

But research never ends. Exploration continues for light sources that are ever more energy-efficient, providing more light for the lighting dollar.

Improved reflector types of incandescent lamps will enable lower-wattage units to handle bigger lighting jobs. Fluorescent research is concentrating on improved color, new shapes, ballast miniaturization, and units that can be easily installed in screw-in incandescent sockets. Flashbulb research is directed toward new multiflash products providing better light for photography. And work continues on making the highly efficient high intensity discharge lamps even more versatile and effective.

In fact, after almost 100 years, GE researchers believe that lamp technology is still in its relative infancy and that tomorrow's technology will lead to even greater breakthroughs in the conversion of electrical energy into light.

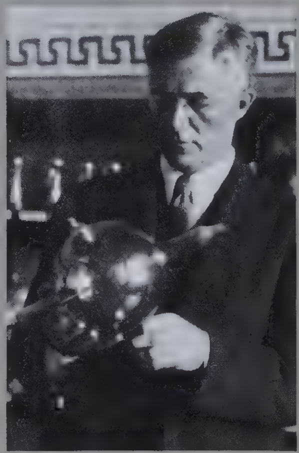
The pioneers: Irving Langmuir

When Dr. Irving Langmuir was asked to deliver a series of lectures at the University of California in 1946, he chose as his title, "Science for the Fun of It." Few people had more fun with science than Irving Langmuir.

Born in Brooklyn of well-to-do parents, he received a degree in metallurgical engineering from the Columbia School of Mines and a Ph.D. in chemistry from the University of Göttingen in Germany, where he studied under famed Professor Walther Nernst. After teaching at Stevens Institute of Technology for three years, he applied for a summer job in 1909 at the General Electric Research Laboratory.

Langmuir's scientific credentials were good enough for Dr. Whitney to tell him to work at whatever he pleased. Langmuir stayed at the Laboratory for another forty-one years, and no one ever gave him any other instructions.

It took him only two days to decide that he wanted to work on the deterioration of tungsten filaments in light bulbs, and this work soon led him to discover that inert gases were far superior to the vacuum then used in the bulbs. But this did not keep him from inventing a mercury condensation pump to create a better vacuum than had ever been made before.



Dr. Langmuir's early work on the emission of electrons by hot filaments in a vacuum led to the formulation of his theory of adsorption, describing the formation of single layers of molecules on the surfaces of liquids or solids. His work on surface chemistry formed the basis for a Nobel Prize in chemistry in 1932 — just a dozen years after Dr. Nernst, his German professor, received *his* Nobel award. Langmuir also made important contributions to electronics, plasma physics (he coined the term "plasma"), and the structure of atoms and molecules. He and Dr. Vincent J. Schaefer developed the seeding principle for the precipitation of moisture from clouds.

From the time of his retirement from General Electric in 1950 until he died in 1959, Langmuir remained a consultant to the Laboratory, still having fun with science.

2. After the lamp, 'a complete electrical system'

Edison was a man who attacked problems systematically. He would first decide on his objective, study all the data he could find, immerse his mind totally in the problem and its ramifications, and let the flashes of insight come of their own accord.

In the case of incandescent light, the objective as he saw it was to provide not just lamps but illumination to homes and places of work. That meant both lamps and a reliable source of electric current. Or, as he put it, "a *complete system* for the distribution of electric light in small units in the same general manner as gas." He had become convinced that central generating stations would provide the most efficient and economical method to distribute electrical power.

What made the system especially difficult to create was the fact that virtually everything in it had to be either invented or designed from ground zero. There were at the time no switches, fuses, meters, connectors, electric light fixtures, regulators or dozens of other needed items.

But even while the work on the lamp was being intensively pursued, Edison and members of his staff were dividing their energies to work out other problems. Throughout 1879, for example, they experimented at their Menlo Park laboratory with dynamos to generate electricity.

Francis Upton, the mathematician, made numerous experiments and finally decided that rather than making the dynamo's armature of solid iron, it should be made of laminated steel discs, mounted on a common shaft but insulated from each other. To provide a powerful magnetic field, the dynamo had large magnets, rising more than three feet and joined at the top by an iron crosspiece, so that the entire apparatus looked like a large Roman number II. The generator was officially named the Edison bipolar, but laboratory workers more irreverently named it the "long-waisted Mary Ann," a designation that quickly took hold.

In December 1879, a central station with three six-kilowatt bipolar generators was set up near the laboratory. Before Christmas some 80 lamps had been installed in the laboratory, Edison's home, other nearby houses and on the street, and all were lighted in a public demonstration on New Year's Eve.

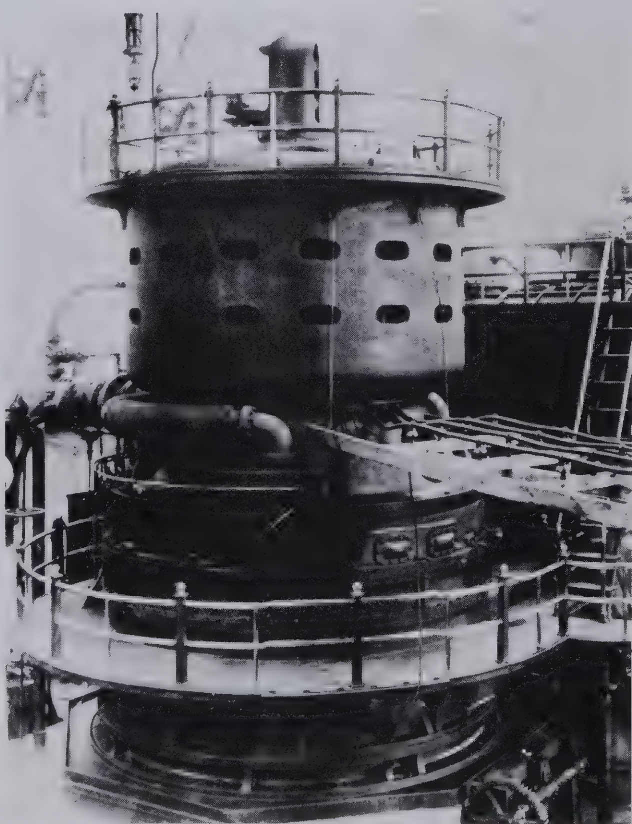
Lights for New York City

While central power was deemed preferable for large numbers of small electric power consumers, the Edison company also built what it called "isolated" stations for large industrial plants. The first of these was installed at the New York plant of Hinds, Ketcham and Co., lithographers and color printers, and it began operating in January 1881.

Plans for the first U.S. commercial central generating station were drawn late in 1880. The site, at 255 Pearl Street in Manhattan, was purchased in August 1881. By then the Edison staff had developed large "jumbo" dynamos, driven by steam engines. The Pearl Street station was equipped with six of these. Fourteen miles of underground cable were laid, encased in wooden tubes. For insulation, asphalt dissolved in boiling linseed oil was pumped into the tubes. Meters for the system's original customers used the principles of the electrolytic cell, with the weight of the metal deposited indicating the amount of electrical energy used.

The Pearl Street station began operations on September 4, 1882, providing electrical current initially for its 85 customers' 400 lamps. The station's full capacity was 600 kilowatts, enough to light as many as 7200 lamps. It was not long before those limits were being approached and the station's generating capacity had to be expanded.

By 1887 there were 60 Edison central-station companies, lighting some 150,000 lamps. The Edison Machine Works was kept so busy building dynamos that it soon outgrew its New York City plant and moved to more spacious quarters at Schenectady, N.Y. This was the beginning of one of General



First GE steam turbine was designed by Charles Curtis and supplied 5000 kilowatts to Commonwealth Edison of Chicago in 1903. Today, modern nuclear steam turbines rated at more than 1,000,000 kilowatts (opposite page) are teamed with nuclear reactors to provide electricity efficiently while conserving fossil fuels.

Electric's principal manufacturing facilities.

A-c versus d-c power

Thomas Edison had built his system using direct-current (d-c) electricity. As time passed, he found it difficult to realize and accept that a competing system utilizing alternating current (a-c) offered distinct advantages.

Fortunately for the early development of General Electric, Elihu Thomson appreciated that a-c technology was the wave of the future. He brought out a transformer for electric resistance welding in 1885, and in 1888 organized the Thomson Welding Company. Convinced that the high-voltage a-c system was bound to come, he started to develop protective equipment for its use. By 1887 he was ready to place an a-c dynamo on the market.

At the time of the incorporation of General Electric in 1892, both the Edison General Electric Co. and the Thomson-Houston Electric Co. were operating a-c systems. In the Edison enterprise were some 375 central-station power companies and more than 2300 isolated power installations, while Thomson-Houston added some 870 central-station companies.

The "war of the currents" was effectively brought to an end by Thomson-Houston's rotary converter, invented by Charles S. Bradley. The converter made possible the interchange of a-c and d-c power.

The fledgling General Electric Company received another boost in its a-c power capability when William Stanley, who had perfected an efficient transformer as early as 1886, merged his company with GE in 1903. His facilities in Pittsfield, Mass., grew into the Company's present-day center of research in high-voltage transmission, as well as into a major GE plant manufacturing power delivery apparatus and other products.

Steam turbines take over

The steam turbine, designed to replace the reciprocating steam engine, was pioneered in the 1880s by Charles A. Parsons in Great Britain, and applied to electric power generation. The concept involved the rush of steam through nozzle-like passages formed by vanes. The reaction of expanding steam against turbine blades generated power. At GE, Charles Steinmetz examined the turbine concept, thought it a good idea, but felt that the Parsons model was too complex.

One day toward the end of 1896, Charles G. Curtis, a New York patent attorney who had started his own electrical business, came to see Edwin W. Rice, Jr., GE's technical director. He brought in plans and drawings for a new turbine design, and Rice found it interesting enough to agree to have General Electric use its facilities for the development work, in exchange for sharing the eventual benefits if the device could be made commercially successful.

After three years, however, it was recommended to Company management that the tests be abandoned. Rice, unwilling to give up, turned the problem over to a Lighting Department engineer, William L. R. Emmet, who knew next to nothing about turbines but who had made significant contributions in a-c technology.

Emmet recommended building two small machines, with capacities of 500 and 1500 kilowatts. The new Curtis-Emmet turbines were built with multiple rows of blades, in place of the single row in the Parsons turbine. But Emmet's key suggestion was to set the whole turbine shaft vertically, spinning like a top, thus reducing the friction caused by the weight of the wheel. This made possible a jump in rating to 5000 kilowatts.

A Chicago utility, Commonwealth Edison, had the daring to order two of these untried units for its Fisk

The pioneers: Elihu Thomson

At the Philadelphia Centennial Exposition of 1876, Elihu Thomson spent countless hours studying exhibits of the Gramme dynamo, an electroplating tank, and another dynamo hooked up to a motor that drove a pump. It was there that he decided to devote himself to electrical inventions.

He was then, at the age of 23, a teacher at Philadelphia Central High School, from which he had graduated six years before. Taken under the wing of another young teacher, Edwin Houston, Thomson conducted experiments in early wireless, on which Houston published a paper.

In 1876, Thomson was invited to give five public lectures on electricity at the Franklin Institute. He delivered them to packed houses, and during the final lecture he stumbled on the principle of electric welding, when two copper wires fused during a demonstration that employed a discharge from a Leyden jar. This turned up among the more than 700 patents he was granted, including those for the electric meter, the oil-immersed transformer, a cream separator, and the grounding of distribution transformers to prevent high-voltage shocks.

Thomson left his teaching job and moved from Philadelphia to New Britain, Connecticut, in 1880 to devote all his time to the invention and design of electrical equipment. He did extensive work on the development of an improved arc-lighting system. The commercial outlet for his talents was the American Electric Company, which was not successful. But it did attract the attention of a group of businessmen in Lynn, Massachusetts, headed by Charles A. Coffin. They organized the highly successful Thomson-Houston Company, which later became half of the merger that formed the General Electric Company, of which Coffin became the first president.

Street station. It was a gamble that paid off, for when the turbines went into operation in 1903 they equaled the capacity of the largest steam engine, yet required only one-tenth the space and weighed one-eighth as much. Moreover, they cost only one-third as much as an equivalent piston-engine generator.

The success of the Curtis turbines gave General Electric a lead in the power generation field it has never relinquished. The swift technical progress achieved by GE engineers outmoded the 1903 turbines within six years. One was returned to Schenectady, where it stands as "a monument to a decisive industrial victory."

Today the steam turbine-generator remains the lowest-cost producer of electric power in large quantities. A single GE machine can supply the electrical needs of a city of more than a million people and can do it while burning only a fraction of a pound of coal for each kilowatt-hour of electricity, compared with some seven pounds before the Curtis turbine came into use.

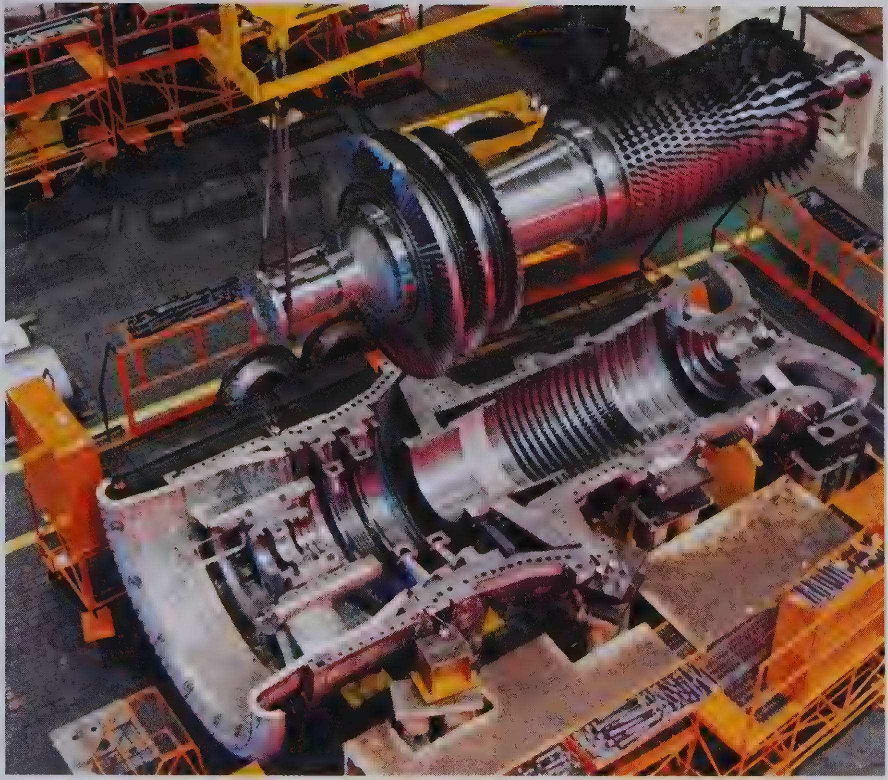
Power from gas turbines and the atom

From the earliest days of turbine technology, engineers were intrigued by the possibility of turning the turbine's buckets by the direct thrust of burning gases rather than by steam. But practical use of gas turbines had to await new developments in metallurgy and other technologies.

Development of gas turbines was given a powerful boost by successes in building gas-turbine aircraft engines at the end of World War II. Having built the engine for the first U.S. jet aircraft, GE continued the development of aircraft gas turbines but also began more active exploration of gas turbines for locomotives and for electric power generation.

Heavy-duty gas turbines for power plants have been evolved into a successful worldwide business by General Electric. Industrial applications include plants to provide power for pipeline pumping. In power generation, they provide extra capacity that can be swiftly brought "on line" to meet peaks in electrical demand. Also, in areas of fast economic growth, gas turbines offer factory-built power plants that can be installed on shorter construction cycles than is possible for more customized installations.

Gas turbines have also been successfully teamed with steam turbines in combined-cycle plants that General Electric calls STAG® — for steam and gas — plants. These combined-cycle plants have proved more efficient in power generation because they use the exhaust heat from the gas turbines to help



Newest GE heavy duty gas turbine (top), the MS6001, meets stringent environmental standards while providing high reliability and efficiency to electric utilities.

Above, Japan Atomic Power Company's new Tokai 2 station includes GE 1,100-megawatt nuclear plant.

produce steam to drive the steam turbines.

Another line of development for power generation systems has been that of substituting nuclear heat for the combustion of fuels in order to boil water. This was the great dream that grew out of World War II atomic technology — to harness this great force for peaceful power production.

GE's work in nuclear science dates back to 1940, when Research Laboratory scientists Dr. Kenneth H. Kingdon and Dr. Herbert C. Pollock served on one of two U.S. teams who succeeded in separating U-235 from natural uranium — an essential step in progress toward sustaining a chain reaction.

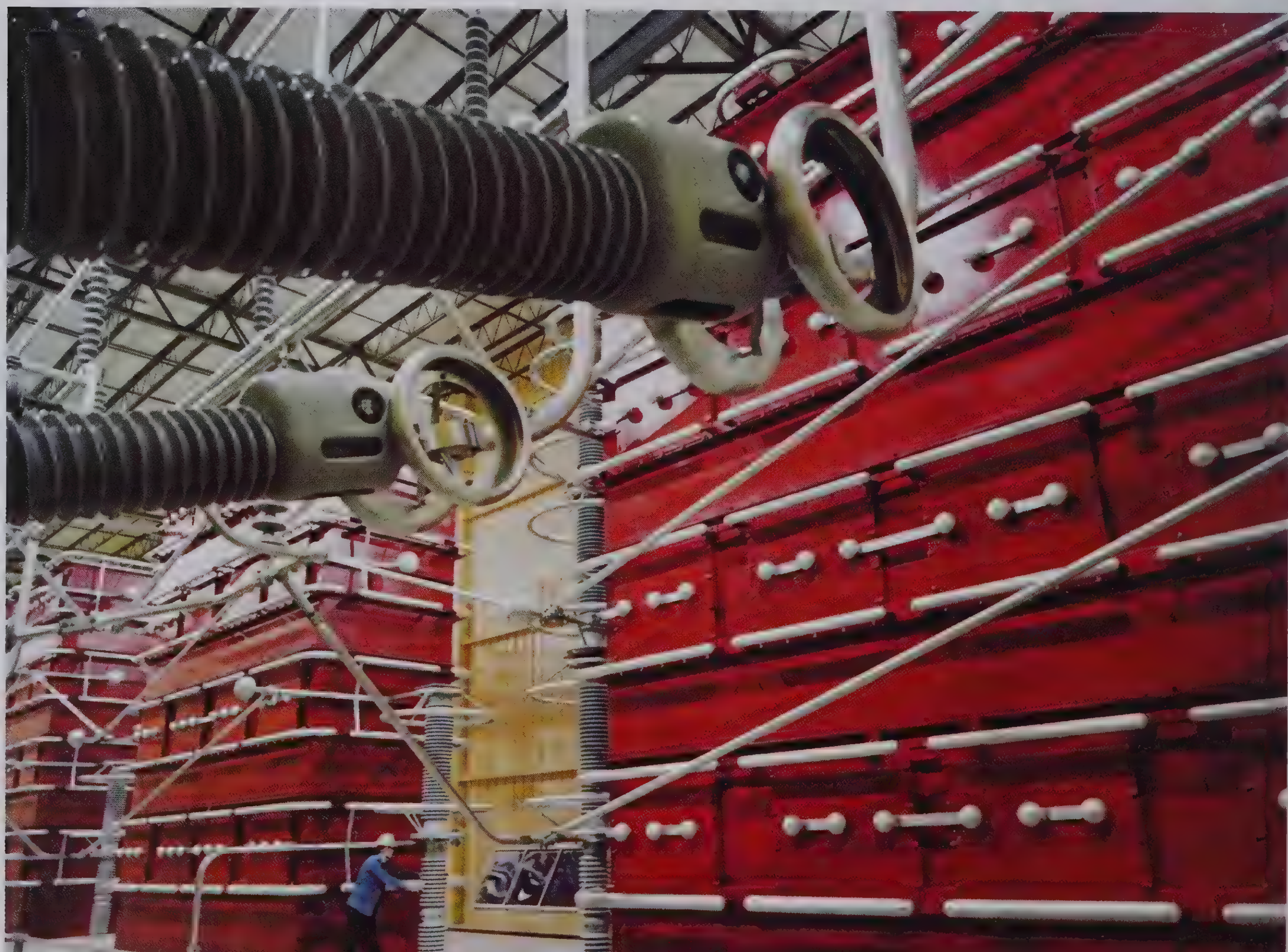
During the war, General Electric contributed to the U.S. "Manhattan Project" and, in the postwar years, undertook the development of nuclear reactors for U.S. Navy submarines at the GE-operated Knolls Atomic Power Laboratory in Schenectady. And in 1956 the Company established its commercial nuclear business.

In 1957, GE received the U.S. Government's Power Reactor License Number One for its 5000-kilowatt nuclear generating facility near Pleasanton, Calif. This was the first of some 110 GE-type nuclear power units that, in mid-1978, were operating or on order in 11 countries.

Advancing the science of power delivery

Just as new power generation technologies replaced Edison's bipolars, new electrical transmission techniques soon supplanted his wood-cased cables and electrolytic meters. Whole new technologies grew up around the processes of power delivery.

A dramatic early GE project involved transmitting electric power generated by Niagara Falls to the city of Buffalo, 26 miles away. Begun in 1894, this line demonstrated what could be done in transmitting large blocs of power. GE transformers "stepped up" Niagara's electricity to an unprecedented 10,000 volts for transmission to Buffalo, then stepped it down again to low voltages for the city's use. Electricity had found the seven-league boots that could send it striding across the miles to serve distant communities and interlink electrical systems in the evolution of a nationwide grid.



Modern transmission technology includes the nation's first all solid-state high-voltage direct current system at Duluth, Minn., built by GE. Future ultrahigh-voltage transmission systems are researched at GE site near Lenox, Mass. (opposite page).

A seminal figure in these early efforts was Charles Steinmetz. His mathematical calculations aided the Niagara project. Continuing his interest, he resolved to find new ways to protect electric lines against lightning. "If I could only be there when it strikes, I could see how it works," he used to say. Then he had an inspiration: he would create artificial lightning to strike when and where he wanted it. From his laboratory-created lightning bolts Steinmetz evolved the knowledge underlying new forms of lightning arresters, insulating materials, circuit breakers and switchgear.

GE's technical staffs have contributed innumerable advances to power delivery technology, from more efficient transformers to highly accurate watt-hour meters and new methods of underground distribution. One area of active exploration today would be dear to Edison's heart: the resurgence of interest in d-c technology. Long-distance transmission by high-voltage d-c lines now makes it economically feasible to locate generating plants near mines — in effect, sending "coal by wire" to the cities where the electricity is used.

Developing new power sources

General Electric management has taken the public position that to avoid energy shortages the U.S. must pursue *all* of its viable energy options, including rigorous conservation efforts along with increased use of coal, greater reliance on nuclear energy and continued development of advanced energy technologies that have not yet proved to be economic.

General Electric itself is seeking to advance a number of these longer-range energy technologies. A major project at the GE R&D Center in Schenectady, N.Y., as an example, aims at an economic process to produce clean-burning gas from coal. A variety of GE projects are concentrating on improving solar collectors, solar heating and experimental solar generating systems. General Electric is participating in the generation of power utilizing wind-driven turbines, geothermal heat and marine-growth biomass, and in the development of the breeder reactor which will "breed" new nuclear fuel even as it supplies heat for electric power generation.

The pioneers:
William L. R. Emmet

William Emmet was an engineer who believed firmly in following instructions, but only when they made sense. As a result he became known as an innovator who could almost always improve existing machines or design new equipment that usually performed better than what the inventors had originally built.

An 1881 graduate of the U.S. Naval Academy, he was discharged when Navy programs were being cut back in 1883 and went to work as a handyman for a small firm that made arc and incandescent lights. It was a lowly job, but he used the opportunity to study and learn all he could about electricity. By 1888 he felt he knew enough to apply for work with Frank J. Sprague, and was given a job as a helper installing electric railroad equipment. At times he exercised his ability to overlook, if not totally disregard, the orders of superiors, and was thus able to solve some important problems for his company, in one instance by completely rewiring all the motors of a street railway system in order to overcome a malfunction.

Emmet joined the Chicago office of the Edison General Electric Co. in 1891, and moved to Schenectady as a General Electric employee the following year. There he put his unusual talents to effective use. He developed the arrangement of buckets and nozzles that made the Curtis steam turbine an efficient machine in 1901, opening the way to the development of a major new industry. He worked on electric drives for ships, particularly for large Navy vessels. His inventions ranged from varnished cambric cable insulation to a process for vaporizing mercury in turbines for the generation of electric power. Thus it was that Emmet lived up to his reputation for improving virtually everything he touched.

3. Trolleys, trains and ships

The steam engine had answered an old dream of mankind: to move faster and more effortlessly than legs or beast could carry one. So it was not surprising that people thought very early of harnessing the new force of electricity to the same end.

Thomas Edison was not one to be left out of such efforts. He built his own electric railway at his Menlo Park, New Jersey, laboratories in 1880, with an experimental electric locomotive that ran at ten miles an hour. Two years later Edison ran an improved locomotive at 40 miles an hour. Then his interest flagged, partly because he was busy forming electric power companies and partly because he believed that the powerful and fast steam locomotives, inefficient though they might be in their profligate use of energy, were serving the need quite adequately.

Others proved more persistent. Two of these were Walter Knight, an inventor, and E. H. Bentley, who had been an examiner in the U.S. Patent Office. They joined forces in a new company, and by July 1884 were operating the electric streetcars of the East Cleveland Street Railway Company. This pioneering venture had serious technical shortcomings, however, and it showed no economic advantage over animal motive power for city streets.

The first trolleys

The development that gave electric street railways an economic edge was that of Charles Van Depoele, a Belgian who had immigrated to the United States, become a successful furniture manufacturer, and then turned inventor. His idea was a trolley running from the car to an overhead power line, and it was exhibited at the Toronto Exhibition of 1885.

But formidable technical problems remained. The man who overcame most of these was Frank J. Sprague, who innovated double-reduction gearing, a satisfactory method of motor suspension, and the successful application of overhead current collection.

As the street railway business began to look more attractive, other companies decided to enter the field. One of these was the Thomson-Houston Company which brought together the expertise of Bentley and Knight, the imaginative young engineer Albert Rohrer, who had become captivated by some of Thomson's inventions, and Charles Van Depoele.

Edison's 1880 electric locomotive (left) was first step in later GE developments in electric traction preserved at Branford Trolley Museum, E. Haven, Conn. (right). In 1920, a GE electric locomotive proved its worth in a tug-of-war against two steam engines (below).

The New Series General Electric C30-7 diesel-electric locomotives are shown on the opposite page hauling a coal train along Montana's Yellowstone River.

Electric locomotives

When Thomson-Houston and the Edison company merged in 1892, the newly-formed General Electric Company became by far the leading factor in the street railway business. GE that year hired Dr. Hermann Lemp, who was to play a major role in the Company's electric locomotion development.

In its first year, the new Company built a 30-ton electric locomotive, which was exhibited at the Columbian Exposition in Chicago. GE also received a contract for the electrification of a six-mile elevated railway line in 1893, and the following year it built the first modern electric freight locomotive for the Cayadutta Railroad in Gloversville, New York. This locomotive remained in service until the 1960s.

In 1894 GE electrified the Baltimore & Ohio Railroad's Mount Royal Tunnel, and the following year it built three heavy-duty electric locomotives to be used in the tunnel. But electric locomotion was still a long way from making significant inroads on main-line railroad business. Although operating costs were often lower, the investment required for track electrification was prohibitively high.

Enter the diesel-electrics

GE's transportation engineers realized that one way to get around the cost of electrifying tracks was to put the power source right on the train itself, rather than have it come from a distant dynamo. The first try at this, in 1904, was with a gasoline engine to drive the generator, which would in turn produce electricity for power and for controls. That same year General Electric organized a Gas Engine Department under Henry Chatain, with Lemp as consulting engineer. They built the first V-8 gasoline engine

in the United States, a 175-horsepower unit.

But the real future for self-powering locomotives grew out of a meeting between Dr. Lemp and Rudolf Diesel in 1910, when the engine developer visited the U.S. Lemp immediately saw the possibilities of the diesel-electric as a locomotive power drive.

The engineering problems of designing a diesel engine for railroad use, however, were more difficult than he had imagined. It was not until 1918 that Lemp and his associates had accomplished this feat, and even then the first three were scrapped because of engine failure.

Gradually the diesels began to prove themselves in mainline use, and in 1924 the first commercially successful diesel-electric was sold to the Central Railroad of New Jersey, with the first single-unit diesel-electric put into service on the Baltimore and Ohio in 1935. But while technical performance and power ratings continued to improve, commercial development of the diesels was slowed, first by lack of orders during the Depression of the 1930s and next by materials shortages during World War II.

As late as 1946, one study of the transportation industry spoke of diesel-powered locomotives as having a very promising *future*. But the future had already arrived. In that first postwar year, more than 1,000,000 horsepower in diesel-electric and electric locomotives were installed on the nation's railroads, about twice the amount for the average prewar year. In 1947 GE alone shipped more than 1,000,000 horsepower in transportation equipment. By the mid-1950s, steam locomotives had all but vanished from the nation's railroad systems.

Electricity for ships

The application of electricity to ship propulsion was another technological opportunity that had been recognized as early as 1909 by GE consulting engineer William Emmet. Convinced that turbine-electric drives would be practical and economical for large vessels, Emmet urged the U.S. Navy to give electricity a fair trial. In 1913, the Navy agreed by commissioning the collier *Jupiter*, which soon demonstrated the value of turbine-electric drives for maritime use. This was followed in 1915 by the all-electric ship *New Mexico*, which firmly established marine electric drives as economical and reliable. The General Electric success with these two ships resulted in the Navy's adoption of electric drives for all its capital ships. With the acceptance by the Navy of electrical propulsion, the civilian maritime market also opened to this technology.

Marine propulsion technology was developed by the Company over the years, and by World War II, General Electric marine systems were powering some 1700 U.S. Navy and Merchant Marine ships.

New developments on land and sea

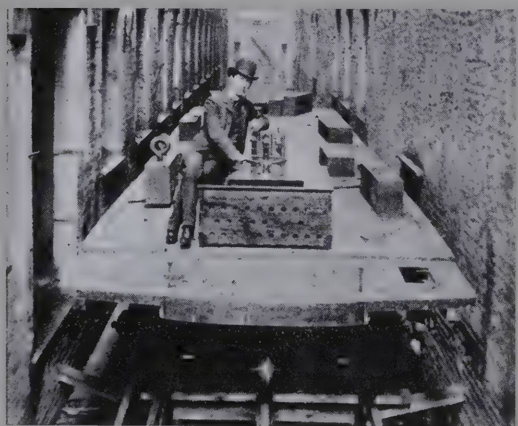
The nation's gradual urbanization over the 100 or more years preceding World War II took on new impetus after the war, and by 1960 cities were growing four times as fast as the rest of the country. This meant increasing traffic congestion and new demands for moving large numbers of people more swiftly and economically.

By 1954, GE had provided an answer by developing electric propulsion equipment for lightweight, high-speed rapid transit cars. The first units were delivered for the Chicago Transit Authority and as the business grew, systems were also delivered for New York City, Boston and Cleveland. Fully automated rapid transit equipment was produced in 1969 for the Philadelphia-Lindenwold, New Jersey Line. The trend to high-speed interurban passenger service led to additional GE equipment being added to the busy

The pioneers: Frank J. Sprague

The clang of a trolley bell was sweet music to the ears of inventor Frank Sprague. Early in his career he had worked for Thomas Edison, constructing new electrical generating stations, but his evenings were devoted to experiments on electric motors. In 1884, his fascination with electric traction led to his departure from Menlo Park to establish the Sprague Electric Railway and Motor Company.

Improved motors developed by the inventor were soon being applied to the nation's electric trolleys which rapidly replaced horse-drawn cars. A significant achievement by Sprague was the construction in 1887 of a 40-car, 12-mile urban railway for Richmond, Virginia, that was the nation's first large-scale electric streetcar system. Sprague then went on to electrify the larger West End Street Railway in Boston.



In 1892, the inventor produced a 1000-horsepower electric locomotive and a year later he began building the first modern electric elevator. But perhaps the most widely used Sprague invention was the "multiple unit" system of train control that allowed assembly of any number of cars into trains controlled from any point in the train, with each car equipped with its own motor and controller. His system was first used on the Chicago Elevated Railroad in 1897 and was soon in use the world over.

Sprague's interests were merged with those of General Electric in 1903, and the inventor worked with the Company on the electrification of Grand Central Terminal in which his multiple unit system was applied to the coupling of new GE electric locomotives.

The pioneering work of Sprague undoubtedly accelerated the development of electrified urban transit by a number of years.

Northeast Corridor, including sophisticated Metroliner trains running between New York and Washington. More recently, GE has built passenger locomotives for the Amtrak system capable of speeds in excess of 100 miles per hour.

Demand for GE equipment has also grown in international markets, with high percentages of the locomotives built annually at the Company's Erie, Pa., facilities being shipped offshore. Most of these orders have been for diesel-electric units. But interest in GE all-electric locomotives also continues.

Another area of exploration by General Electric has been the application of gas turbines to marine transportation. Both aircraft-derived and heavy-duty land types of gas turbines have proved themselves as marine powerplants. GE aircraft-derived engines now power fast, lightweight ships for the navies of 11 countries and are being developed for the merchant marine market. And GE powers the world's first commercial ship driven by a heavy-duty gas turbine — the "Iron Monarch," a 15,000-ton Australian cargo ship that by 1977 had set an endurance record of over 10,000 hours of operation.

Today, diverse GE technologies are being applied to the world's transportation needs. GE marine steam turbine propulsion equipment of up to 100,000 shaft horsepower and various types of gas turbines are being supplied for roll-on/roll-off containerships, bulk carriers, liquefied natural gas carriers and naval vessels. GE locomotives ranging from small mining and switching types to 3600-horsepower diesel-electrics are moving freight and passengers around the free world. Huge motorized wheels, in which part of the electric motor also serves as the axle to reduce vehicle weight, have been developed by General Electric for use in open pit mining, providing economy and flexibility in trucks of 85 to 170 tons payload. Transportation research for the Company's second century also spans new components for prototype electric automobiles. General Electric is well-positioned to play a strong role in meeting the world's future transportation needs.

Early GE ship propulsion technology was used on the S. S. Pacific *(above) commissioned in 1915. It was the first large cargo steamer of moderate speed built in the U.S. to be equipped with geared steam turbine propulsion.*

Contemporary marine propulsion systems from General Electric are powering new generations of containerships (right) that help shippers integrate land and sea transportation into a single intermodal system.

4. Giving voice to communications

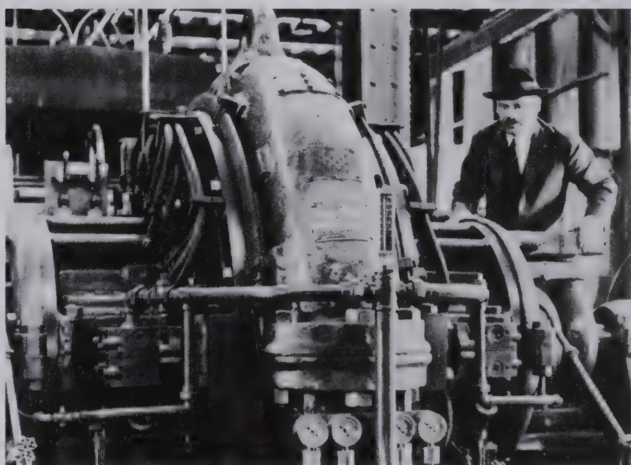
Italian inventor Guglielmo Marconi had fired the world's imagination by developing wireless telegraphy in 1895 and 1896. But the infant technology was limited in the range and power of its transmissions and was confined to the dot-and-dash sputterings of Morse code. Could this new form of communication be given a voice that could be heard across oceans?

A University of Pittsburgh professor, Reginald A. Fessenden, thought it could be done, by modulating — or varying — the frequency of the radio signal.

What he needed was an alternator — a device that could change direction thousands of times a second and at the same time generate more power than any machine yet envisioned.

Fessenden brought his problem to the General Electric Company. Fortunately, his request came at the time when the young Swedish engineer, Ernst F. W. Alexanderson, had completed his first assignment for the Company — a single-phase railway motor. Alexanderson was asked to help Fessenden with the alternator.

The job took him two years of unrelenting effort. But in September 1906, a two-kilowatt, 50,000-cycle GE alternator was installed in a transmitting station at Brant Rock, Mass. On Christmas Eve, ship radio operators on the stormy North Atlantic received the signal "C.Q., C.Q.", indicating that what was to follow would be of interest to all. What did follow was no longer Morse code, but human voices — a woman singing, the reading of a poem and a man delivering a talk. There was also a violin solo. It was the first radio transmission of voice and music.



Radio pioneer Dr. E. F. W. Alexanderson of General Electric (right) built an alternator that made possible the first broadcast of voices and music in 1906. Later experiments covered radio receivers, antennas, radio altimeters and, in 1927, a home demonstration of the first television receiver (below).

Alexanderson's alternators

When the American Telephone and Telegraph Company came to General Electric for advice on stepping up the power in long-distance telephony, the problem quite logically ended up in Alexanderson's laboratory.

Alexanderson used the magnetic saturation effect in iron to develop a magnetic amplifier, which could take the weak power from the microphone and increase this to the high power needed for the transmitting antenna.

But when Alexanderson tried the magnetic modulator on radio telephony, he found it would not work because the electrical impulse from the microphone was too weak. So he scouted around the Research Laboratory, where Dr. Irving Langmuir had developed a new type of vacuum tube, the pliotron, which could operate at up to 50,000 volts and handle kilowatts of power. It was exactly what Alexanderson needed to amplify his tiny radio signals. Shortly thereafter, transoceanic telephone service became a reality.

As Alexanderson moved to develop an efficient, high-power transmitting unit that could be effective over long distances, Marconi was watching his work closely. In 1915 Marconi made a special point of coming to the Schenectady laboratory to study Alexanderson's alternator. He asked that Alexanderson design a large alternator to generate power for the new wireless station of the American Marconi Company in New Brunswick, N.J.

A 200-kilowatt machine was completed and installed early in 1918, in time to become the basis of wartime radio communications between the United States and its European allies. The New Brunswick alternator included a very large disk, weighing several tons, which was designed to revolve at high speed, so that its outside circumference travelled at 700 miles an hour. Yet it was so precisely built that its position never varied more than .003 inch and its speed no more than a small fraction of a revolution per hour. When the war ended, President Wilson's "fourteen points" for peace were broadcast to Berlin from New Brunswick.

Efficient communication systems are being provided by General Electric to communities such as Indianapolis (above), to coordinate police and fire-fighting operations from a series of consoles.

Commercial radio and television

The work of Alexanderson and Langmuir put General Electric in a very strong position in commercial wireless development and in electronics after the war. Langmuir and his associates developed high-vacuum diodes and triodes which were among the important foundation stones of modern electronics. Alexanderson was named head of GE's newly-organized Radio Engineering Department in 1918 and later turned his hand to the transmission of pictures by wireless, first still pictures by facsimile, then moving pictures by television. This meant a need to develop new equipment — tubes and directional antennas — and to use new frequencies. In June 1924 he sent a handwritten greeting to his father in Sweden by wireless, the first transoceanic facsimile transmission.

The wavelengths used for facsimile turned out to be unsuitable for sending moving images through the air. So Alexanderson set to work on this problem. Using a device known as a Nipkov disk, he could make a tiny picture, which could be magnified by a lens. The first home television demonstration took place in his own home in 1927, and a year later there was a public showing of the new medium.

In the meantime, General Electric had been developing another facet of its communications business — that of operating radio broadcasting stations.

The first of these, WGY in Schenectady, went on the air in February 1922. Shortwave stations operated by GE began multilanguage broadcasts as early as 1925 and stirred worldwide interest by communicating with the Byrd Antarctic expeditions in Little America. These early GE broadcasts were forerunners of the Voice of America transmissions.

Station WGY and Alexanderson teamed up to produce another GE "first" in 1928, when the teleplay, "The Queen's Messenger," was broadcast by WGY, using Alexanderson's experimental TV system.

Present-day GE businesses include the operation of three AM and five FM radio stations, three TV stations and 13 cablevision systems.

Radio on wheels

The practicality of mobile radio systems was demonstrated by General Electric in 1928 when it equipped a New York Central train with a 50-watt radiotelephone that allowed communication among locomotive, caboose, and signal towers along the right of way. General Electric advocated the use of Frequency Modulation (FM) over conventional AM radio for mobile applications because of its relatively noise-free, clean, full-fidelity qualities, and aggressively pursued its development in the 1930s. General Electric launched its Mobile Radio business in 1934 by installing a two-way AM system for the Boston Police.

In September of 1939, GE convinced the Federal Communications Commission of the benefits of FM in a side-by-side comparison with AM. In 1964 General Electric received a patent for the stereophonic FM broadcasting system adopted as the U.S. standard and in use today.

When World War II interrupted commercial radio and television development, GE electronics people concentrated much of their efforts on wartime needs in radio communications and radar. It was the magnetron, invented by GE's Dr. Albert W. Hull, that the British modified in their early development of radar; however, as early as 1928, Alexanderson had worked out a method of determining a plane's altitude by picking up the reflection of a radio beam bounced off the ground.

From such beginnings, and from GE's intensive work on the development of television, which is closely related to radar, the Company was well-prepared to fill Navy orders for 400 early-warning radar sets for ships in the spring of 1941. These were highly instrumental in helping subdue the submarine menace to Atlantic shipping in the early days of World War II. The Company participated in the design and manufacture of more than 50 different kinds of radar sets during the war years.

At the end of the war, the pent-up public demand for radio and a burst of interest in television kept the Electronics Department busy trying to meet demands. Radios and radio-phonographs, including some with two speakers, were the key products of the Electronics Department at first. But television gradually moved up in importance. The early sets had ten-inch cathode-ray tube screens, but one model projected a picture onto an 18-by-24-inch screen. By the end of 1948, television receivers were being turned out at the rate of 200,000 a year at GE's Electronics Park in Syracuse.

Innovation has continued to support GE's TV business, with developments that have included the introduction of the in-line picture tube, lightweight portable sets, black matrix picture tubes and the VIR or vertical interval reference system in which the broadcast signal adjusts the receiver's color automatically. This year, General Electric also announced its Widescreen 1000 Home Television Theater with a picture three times the area of a standard 25-inch color television receiver.

The pioneers:
Ernst F. W. Alexanderson

As the son of a professor of languages at Uppsala University in Sweden, E.F.W. Alexanderson managed to learn English, French, Latin and German, along with his native Swedish. Thus, during the course of doing postgraduate work at the Technical University in Berlin, when he ran across a copy of Steinmetz' *Alternating Current Phenomena,* he was able to read the volume in English. He decided that he must meet the author.

In 1901 Alexanderson came to the United States and took a job with the C and C Electric Company in New Jersey. On his first available weekend, he journeyed to Schenectady and walked in on Steinmetz. After they talked for a while, the older man urged him to come to work for General Electric, and recommended him for a job. Alexanderson worked first in the drafting department, then completed GE's Test Engineering Course. In 1904 he joined the engineering staff, designing generators under Steinmetz' direction.

Alexanderson was assigned to design an a-c motor to serve the growing railroad market. He built an eminently successful motor, and his design was used in the rewinding of some 100 motors of the Washington, Baltimore and Annapolis Railroad. He also developed several new methods of operating induction motors at variable speeds that were embodied in the design of electrical equipment for the battleship *New Mexico* and other ships of the U.S. Navy.

Alexanderson's major triumphs were in the field of radio, where his high-frequency alternators, perfected before the start of World War I, made possible wartime radio communication between Europe and America. Alexanderson was granted more than 300 patents, many of them in the field of broadcasting, including the magnetic modulator, the multiple tuned antenna, the directional transmitting antenna, and the radio echo altimeter. But always he gave credit to those he worked with, pointing out that "the creative mind needs a safe and resourceful place for action and cooperation."

The information revolution

When computers and computer systems began to impress themselves on the public consciousness in the early 1950s, General Electric had long since been deeply involved with the technology. Early GE equivalents of computers were developed to analyze power transmission systems.

By the early 1960s, the Company had several lines of computers on the market. A major development pioneered by GE in 1963 was computer timesharing, a concept that enabled several users in different locations to access the same computer at the same time. Working with Dartmouth College, the Company developed the concept together with a simple computer language called "BASIC." By 1965, the Company introduced a commercial timesharing service that quickly grew to a 42-city network.

The healthy growth of GE's timesharing business resulted in the expansion of GE service to Europe via satellite in 1971 and then to Japan and Australia two years later. Today, the Mark III® Service computer network provides computational capabilities to over 600 cities in 21 countries in 21 time zones. The network serves over 5000 customers around the world, and can accommodate some 1800 simultaneous users daily through the integration of over 200 minicomputers.

Accompanying the development of timesharing was high-speed teleprinter technology. GE entered the field in 1969 with its Terminet® 300 printer that utilized large-scale integrated circuitry. The printer provided an operating speed of 30 characters per second, three times faster than conventional printers of the day. Today, GE technology covers a wide variety of teleprinters operating at up to 340 lines per minute.

General Electric, principally through its aerospace businesses, has moved into a number of new areas of the modern information revolution. One of these is Genigraphics® computer equipment, using image technology adapted from flight simulation work by NASA and the Air Force. Genigraphics equipment is being put to such uses as business charting, cartography, and animation. GE is also applying space satellites to communications, including the development of the Defense Satellite Communications System that will provide worldwide communications for U.S. defense forces and other Government agencies.

Sophisticated technology such as satellite transmissions characterize GE cablevision operations (left). GE's CATV subsidiary operates 13 systems in New York, California, Illinois, Indiana, Michigan and Mississippi. New high-speed Terminet® 1232 printer (above) typifies strides being made in GE data communications.

5. Technologies to power industry

Following up on Michael Faraday's discovery in 1829 of the cause-and-effect relationship among electricity, magnetism and motion, the early lighting pioneers were mainly interested in feeding in motion, as in a dynamo, and getting out electricity. But the principle could be reversed: feed in electricity and get out motion, as in a motor that could provide the driving power for a countless variety of tasks.

When Edison was asked about this side of the equation, he simply responded: "A young man named Sprague . . . has worked the matter up in a remarkable way. His is the only true motor."

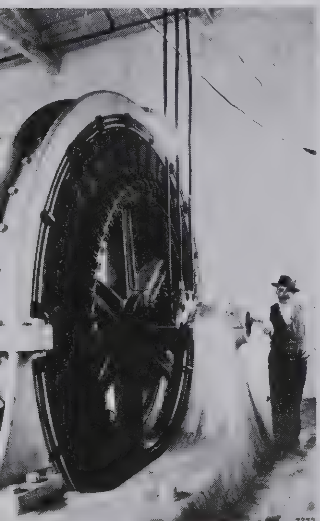
And indeed Frank Sprague had been working on motor development since the days when he had been employed by the Edison company. After he left to go on his own, and when he felt he had developed a suitable motor, he sent salesmen out to several major cities to find potential buyers. He soon placed a dozen of his motors in textile plants in Massachusetts, and by 1886 his company had installed electric motors to drive lathes, printing presses, coffee mills, boot and shoe machines, emery wheels and ice cream freezers. Subsequently he brought his talents to GE.

Edison's company also entered the motor business early, putting the first motors on the weaving looms of textile factories in 1888.

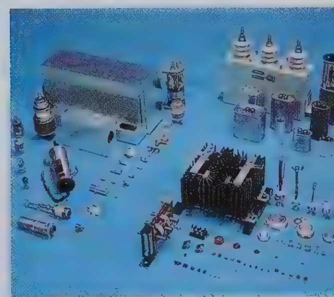
Six years later General Electric motorized an entire large textile plant for the first time. In 1896, GE electric motors were applied to steel mill equipment.

While early motors were all of the direct-current type, the rise of alternating-current equipment

For a century, GE technology has contributed to higher industrial productivity through a variety of drives and controls, including this early textile mill induction motor, circa 1895, and a 6500-hp motor driving a steel plant reversing mill.



GE products and services help customers improve both products and manufacturing processes. Shown below: GE Energy Saver motors that use up to 25% less energy, a wide variety of electronic components, and versatile Logitrol® programmable controllers.



GE's diversified present-day technologies for industry include (top) automated steel mill drive and control systems; (left) compact papermaker developed by Canadian GE; apparatus repair and maintenance Service Shops; and Mark Century® machine-tool controls.

brought a need for a-c motors. But one of the main problems was a phenomenon called hysteresis — the loss of energy that occurred as the magnetism in the motor's core was reversed. It was the kind of problem to which Steinmetz directed his mathematical genius. He formulated the Law of Hysteresis and set in motion the technology to reduce these losses, so that a-c motors came into widespread use.

Rise of the 'application engineer'

American factories late in the nineteenth century were turning out a rapidly increasing share of the world's goods. But with their jungle of belts and pulleys, connected to central shafts turned by steam engines, the factories were generally gloomy, noisy, cluttered and hazardous. It took a while to realize that electric motors could change all that. Each machine could have its own electric motor. With belt drives eliminated, factories could be made safer and more efficient.

General Electric developed a corps of application engineers, who went into the factories of customers to describe the advantages of separate electric motors for each machine. Such motors would conserve energy by working only when the machine was working, and the motors could be individually designed for the tasks they had to perform.

The application engineers were soon learning a great deal about their customers' businesses. Before putting a motor on a loom, they had to know how the loom operated and ran. Before starting to electrify steel mills, they had to become intimately familiar with the way steel products were formed and shaped in the mills. They had to become specialists in the dozens of industries they sought to serve.

The work of these engineers, together with the steady stream of GE motor innovations, gave General Electric a lead in electric motor development that forms the foundation of present large-scale GE businesses in many types of motors.

The average home, for example, makes use of 20 to 25 electric motors. The effect on industry has been steady gains in productivity. In 1900, it has been estimated, the average American workman used only one-tenth of a kilowatt-hour for every hour of work done. By 1920 this had risen to more than a full kilowatt-hour, by 1950 to 6.75 kilowatt-hours, and today to more than 13.

Meeting apparatus service needs

Along with application engineering, GE early developed the concept of apparatus service and specialized engineering support for its products. The Thomson-Houston Company opened a field service shop in Philadelphia as far back as 1882. A year later, in order to assure satisfactory on-site installation, adjustment and maintenance of its arc lamps, the Company established the "Expert," ancestor of today's Installation and Service Engineering field engineer. And over the years, GE has continued to develop special expertise in the process, manufacturing and service engineering that underlie the Company's technological achievements.

GE's present network of apparatus service shops continues to expand. Of the total of 183 GE apparatus service shops, 47 are outside the U.S. Many of these shops offer special capabilities, including repair of non-GE products.

The coming of industrial 'systems'

Electricity continued to strengthen the sinews of industry. In 1946, the first postwar year, GE was shipping motors at the rate of seven million a year. In mining, ten tons of ore were hauled up a half-mile slope approximately once every two minutes by a GE-powered hoist. Equipment first developed for diesel-electric locomotives was adapted to oil-drilling rigs that worked the ocean floor.

In the years following World War II the concept of "automation" seized the attention of industry. The word applied to the use of electronic sensors and "feedback" devices to increase industrial pro-

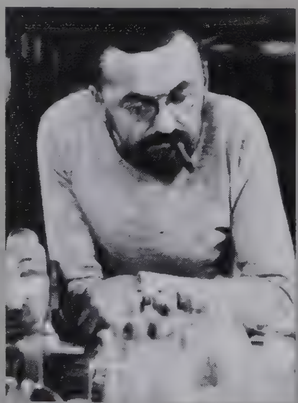
The pioneers: Charles Proteus Steinmetz

To get Charles Steinmetz to come to work for it, General Electric bought the company he was then working for, the Rudolf Eickemeyer factory in Yonkers, N.Y. GE was in fact already interested in the "ironclad armature" manufactured by the Rudolf Eickemeyer factory. When Eickemeyer's company joined GE in 1892, Elihu Thomson and General Electric Technical Director Edwin W. Rice, Jr., agreed that Steinmetz was its principal asset.

Born in Breslau, Germany, Steinmetz fled to Zurich, Switzerland, when *The People's Voice*, a socialist student newspaper he was editing, caught the attention of the police. A year later, in 1889, he immigrated to America.

While working in Eickemeyer's small laboratory, Steinmetz soon became a respected figure in scientific circles by virtue of talks he gave before the American Institute of Electrical Engineers. As he plumbed mysteries of electromagnetic theory, he became known as the mathematical wizard of electricity.

When Rice first met Steinmetz, he found him humpbacked, "his small frail body surmounted by a large head with long hair hanging to his shoulders, clothed in an old cardigan jacket, cigar in mouth, sitting cross-legged on a laboratory worktable." But when Steinmetz spoke — with enthusiasm and a crystal-clear understanding of his subject — his appearance was forgotten.



When his own mind grasped complexities too quickly for his ability to communicate them intelligibly, Steinmetz worked to find ever simpler methods of explaining them. This capacity made him an extraordinary teacher and enabled him to help others understand the end products of his remarkable mental processes.

ductivity. General Electric responded not merely by offering individual motors and other products but by developing whole integrated "systems" that combined many different products to automate entire production processes.

GE systems were applied to steel, paper-making, cement, textiles and petrochemicals. For metal-working operations, GE led in developing numerical controls — devices that could record on tape all the actions to be taken by a machine tool and then guide the machine to perform the process automatically.

Helping industry improve its products

During these years, General Electric expanded its service to industry in other directions. One major area of development was in components to be included in customers' products. In appliance manufacture GE began, early, to produce motors, controls, timers and other components not only for its own consumer goods but for incorporation into the finished products of many other manufacturers.

GE's substantial components businesses have been built by applying technologies to customers' special needs. Thus, tiny new motors were developed as cordless, battery-operated small appliances came into use. General Electric also went into the manufacture of rechargeable batteries. Lamp ballasts were developed for fluorescent light fixtures. For construction industries, GE developed a diverse line of circuit protective devices, electric panel boards, cable and distribution assemblies. As farming became increasingly automated, GE offered motors especially developed to drive haydriers, feed grinders, silo conveyors and irrigation pumps.

Still another broad area of innovation has been in electronic components, beginning with vacuum tubes and extending into new solid-state devices. Out of GE research and development have come important new advances, including the silicon-controlled rectifier which provides more precise control by combining the properties of transistors and power rectifiers. GE development of the tunnel diode gave industry a line of components related to the transistor but surpassing it in speed of operation and temperature range while requiring less power input.

Today, industry is General Electric's largest customer. GE continues to invest heavily in the development of technologies that will further improve industry's products and manufacturing processes. Typical is the introduction of new high-efficiency motors that require less energy while matching the performance of motors they replace — a development that shows General Electric not merely responding to but anticipating a fast-emerging need of its customers in industry.

Power for farms and mines is delivered by GE motors. Rugged 100-horsepower GE motor drives the pump for self-propelled sprinkler system in Nebraska (below). At right, surface mining operations of GE's natural resources affiliate, Utah International Inc., utilize GE-powered dragline.

6. Health care — meeting the needs

General Electric's involvement in medical diagnostic imaging is almost as old as man's knowledge of the x-ray itself.

In November 1895, Wilhelm Konrad Roentgen, a physics professor at the University of Würzburg in Bavaria, Germany, made a startling discovery. Working with a special electrical-discharge tube developed by Sir William Crookes, Roentgen found a mysterious "ray" that could penetrate solid objects impervious to ordinary light. He reported the strange findings in a paper delivered to the Physical Medical Society of Würzburg in January 1896.

Newspapers around the world reacted quickly with sensational stories about the "wonder ray" that could see through anything, and because of its mysterious nature, it soon became known as the x-ray. While it was the butt of much uninformed speculation and humor, serious technologists immediately recognized its possibilities in medical diagnostics.

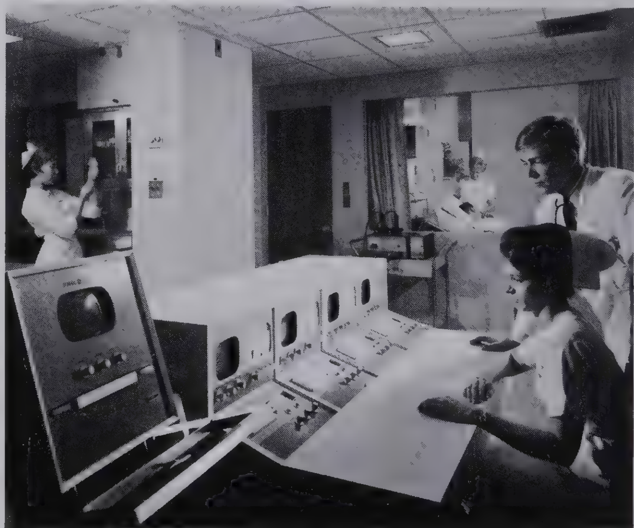
Less than 10 months after Roentgen had delivered his treatise, General Electric announced the availability of a medical "x-ray apparatus" — the first commercial unit of its kind in the United States.

That first unit was developed by Dr. Elihu Thomson. His equipment consisted of a tube with three electrodes, two of aluminum and one of platinum, a form of induction coil known as the Thomson inductorium, and a Thomson Roentgen-ray transformer to supply alternating current to the tube.

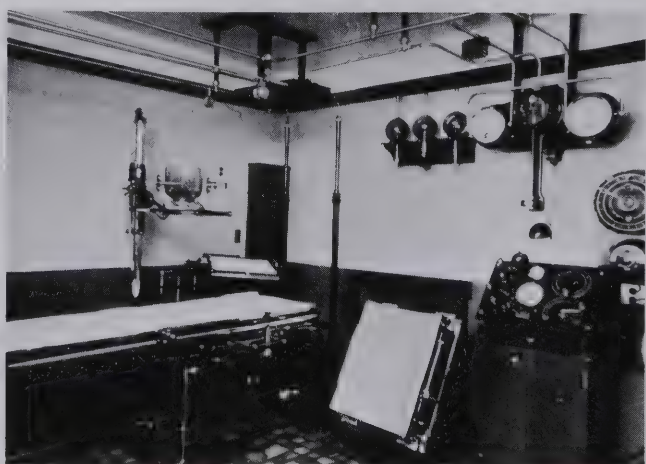
It was far from an ideal piece of equipment. The tubes, using cold cathodes, required a small amount of gas to carry the current; but the gas pressure changed each time a tube was used, so that performance became erratic.

The work of two other General Electric scientists dovetailed to solve this problem. First, Dr. Irving Langmuir showed that it was possible to obtain a pure electron discharge in a high vacuum. Then, based on this finding, Dr. William D. Coolidge devised a new type of x-ray tube using a heated tungsten filament rather than a cold cathode. Operating in a near-perfect vacuum, this tungsten filament — the result of Dr. Coolidge's work in perfecting ductile tungsten — literally "boiled off" a precise quantity of electrons which could then be accelerated into a tungsten/copper target to produce x-rays. The supply of electrons, and thus the number of x-rays emitted, could be easily controlled by changing the voltage applied to the filament. For the first time, radiographers could confidently predict the results of an exposure.

Toward the end of 1913, the *New York Times* reported that Coolidge, "a young scientist at the General Electric Research Laboratory," had invented a new tube "which many believe is destined to revolutionize the x-ray as a diagnostic and therapeutic agent." The hot-cathode "Coolidge tube" quickly became the standard for x-ray tubes and remains



General Electric was among the world's first producers of x-ray equipment, as illustrated below by a turn-of-the-century manufacturing scene and (right) by a 1920-era hospital x-ray room.



After World War II, GE diversified into other areas of medical technology, including patient monitoring (above). A major GE advance has been the fast-scan computed tomography scanner (right), supplying cross-section views of the body for diagnosis.

the prototype for the x-ray tubes used in modern equipment.

Coolidge continued his research to increase the power of the x-ray tube and developed the "cascade" principle that made one- and two-million volt tubes possible.

Meanwhile, a small Chicago manufacturer of engines for dental drills and beer pumps began to make a rudimentary line of generators to supply power to GE x-ray tubes. General Electric acquired a partial interest in the firm, Victor Electric, in 1916, and later bought the company, changing its name in 1930 to the General Electric X-Ray Corporation.

Over the next 20 years, this GE subsidiary produced an impressive stream of new technical achievements in both x-ray and other medical areas: shockproof x-ray equipment; high-power therapy and diagnostic x-ray tubes; diathermy equipment; ultraviolet treatment machines; miniature-film x-ray systems mounted in special vans for large-scale public health surveys; specialized machines for the dentist; and industrial x-ray products.

Around 1950, the General Electric X-Ray Corporation moved to Milwaukee and then was consolidated as the Company's X-Ray Department.

From x-ray into medical systems

During all these early decades, General Electric R&D concentrated almost exclusively on x-ray equipment for medical, dental and industrial use. But the increasing sophistication of health care opened up other opportunities. Subsequently, in the early 1960s, GE began building a more diverse medical systems business on its traditional base in x-ray equipment.

A leading area of product development was in patient care monitoring, applying electronic sensors to maintain constant surveillance of a patient's condition and to alert physicians and nurses when life-threatening changes occurred.

Another important area of medical technology for GE has been in nuclear diagnostics. This medical imaging technique is particularly useful in highlighting certain organs and in surveying large regions of the body for such diseases as cancer.

Computed tomography

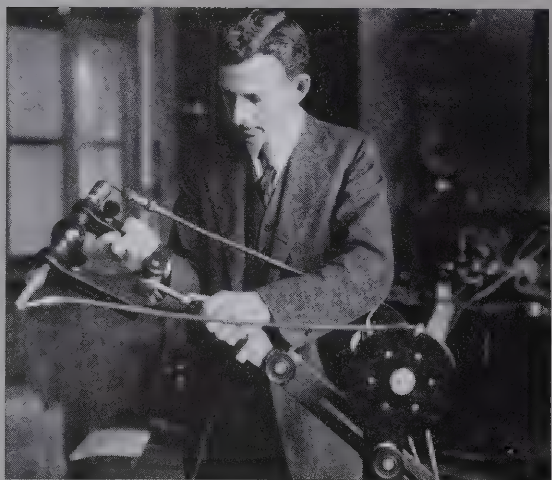
Since the essential element in any medical diagnosis, including x-ray, is information, it is hardly surprising that computers have been pressed into service. As early as 1972, General Electric brought a computerized patient monitoring system to the market and was investigating computers in x-ray systems. These developments, along with more sophisticated x-ray technologies, foreshadowed the perfection of computed tomography, perhaps the most exciting breakthrough in diagnostic medicine since Roentgen.

The word "tomography" is based on the Greek word "tomos" meaning "section" or "slice." Tomography differs from ordinary x-ray imaging in that it depicts a cross-sectional view of the body. And given a number of such cross-sectional views, the physician or technician can get a complete picture of any part of the interior of a patient's body.

The use of early computed tomography scanners was confined largely to the head and brain. This was because these first machines took up to five minutes to collect the necessary information and only the head could be sufficiently immobilized for that long period.

General Electric researchers decided to investigate whether they could speed up the scanning time to

The pioneers: William D. Coolidge



A quiet, unassuming Yankee born on a Massachusetts farm, William Coolidge would probably have been content to carry on his career in the shadow of Willis Whitney, his predecessor and mentor. But Coolidge's own exceptional accomplishments ruled out such a fate.

Because of his family's slim means, Coolidge had no thought of going to college until a friend suggested that he try for a scholarship at the Massachusetts Institute of Technology and borrow the additional funds needed. It turned out to be a superb idea. Coolidge won the scholarship and enrolled in the electrical engineering course at M.I.T. where Whitney was one of the instructors he greatly admired. Graduating in 1896, Coolidge emulated Whitney by joining the faculty, then enrolling at the University of Leipzig for graduate studies, and returning to teach at M.I.T.

Whitney asked Coolidge in 1905 to join the Research Laboratory to work on meeting challenges by competitors to GE's lamp leadership. Coolidge, who had given no thought to such a move, was reluctant to leave his research work at the university. This was a familiar scenario to Whitney, who offered to let him spend as much time as he wished on his own work, and Coolidge agreed to come to Schenectady.

Given the lamp problem, Coolidge decided to work on tungsten as a filament and spent more than two years in alternate disappointment and triumph, until he had perfected ductile tungsten — and revolutionized the lamp industry in the process. Coolidge then developed the first efficient x-ray tube, which he named the "GE tube," but which medical men promptly renamed the "Coolidge tube," a designation that the Company decided to adopt. In 1932, Coolidge again followed in Whitney's footsteps to become director of the Research Laboratory, a post he held for 12 years.

make computed tomography practical for studying areas of the body. They brought together a team of 70 scientists, engineers and technicians from various parts of the Company, and soon developed new x-ray detectors and more sophisticated computer mathematics that enabled scans to be made far more rapidly — and so efficiently that the required x-ray exposure could be sharply reduced.

In December 1975, GE introduced the first sub-five-second computed tomography (CT) scanner, which could complete an entire scan of the head or body in only 4.8 seconds. One doctor likens the scanner to "being able to put a hinge on the body, open it up and see what's inside."

Immediate customer acceptance of the General Electric CT scanner soon placed the Company in a leadership position in the highly competitive CT market. And this position was further strengthened in late 1977 when the high-resolution CT/T 8800 system was introduced.

Looking ahead

Technological advances have also made possible the introduction of such GE products as the Data Camera®, a mobile nuclear diagnostic system with integral computer; the programmable MPX x-ray generator for faster, more precise conventional studies; and the innovative line of RFX x-ray examination tables.

Equipment bearing the symbol of General Electric can be found today in hospitals and diagnostic facilities all over the world, as the Medical Systems Division builds upon its traditional role as the U.S.'s oldest and largest diagnostic equipment supplier, with a firm base in technology, supported by diverse engineering talent and a 1500-technician service organization.

Development of nuclear diagnostic equipment gives doctors an important method for visualizing the body — and has proved invaluable in diagnosing heart disease.

7. Developing man-made materials

Out of GE's early searches for materials with improved insulating properties has grown a diverse technology in materials, as exemplified below by a "direct process" for producing silicones by Research Laboratory chemist Eugene Rochow.

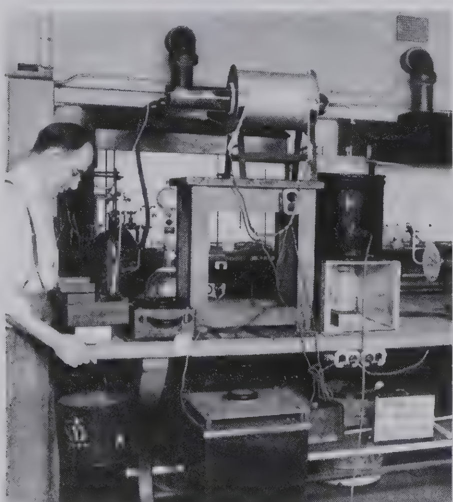
The search for better materials for lamp filaments occupied much of Edison's early lighting experience. Since then, the electrical industry has sought improved materials to do two key jobs: to carry and to inhibit electric current. Copper has been used most widely to solve the first problem. But as for the second: "Insulation," Steinmetz once said, "is by far the most important problem in electrical design."

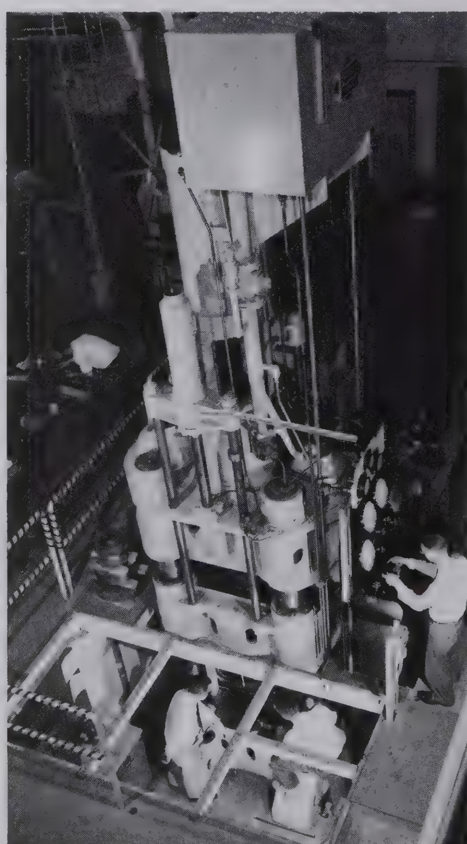
In view of this interest it is not surprising that in employing Dr. Whitney to head the new Research Laboratory in 1900, General Electric chose a chemist. Much of the Laboratory's early work was on materials — witness Coolidge's development of ductile tungsten. And in 1912, insulation research efforts were set up both in the Laboratory and at GE's Pittsfield plant.

Developments in alkyd and phenolic resins resulted in improvements in fashioning molded parts to serve as insulating structures. By the early 1920s, GE's John DeBell, who was subsequently elected to the Plastics Hall of Fame, began large-scale applications of phenolic molding for vacuum-tube bases, and before long, the Pittsfield plant was producing phenolics — the roots for the present business in the improved Genal® line of phenolics — at the rate of seven million pounds a year.

General Electric chemical research picked up momentum in the 1930s under the direction of the Research Laboratory's Dr. A. Lincoln Marshall. One breakthrough was the development of ways to plasticize the new polymer, polyvinyl chloride, so that it could be extruded on wire, and then cured to form a tough flame-resistant coating. The resulting Flamenol® insulation remains the standard for cable insulation.

Another major new find was Formex® wire enamel, a primary insulation used to coat the copper wire wound into coils in electric motors. The GE enamel was so tough and flexible that the wire could be hammered or rolled flat without injuring the coating. More importantly, its high electrical resistance meant that it could be applied in a thinner film for a given electrical stress, thus cutting the size, weight and cost of the motor's magnetic core. Offering greater resistance to solvents and to higher temperatures, Formex insulated wires brought improved motor performance.





Synthesis of the first man-made diamonds by the Research Laboratory in 1954 (right) has led to a worldwide GE business in diamonds and other "super-abrasives."

Silicon and silicones

Beginning in 1937, General Electric entered the relatively new field of organic-silicon chemistry. Eugene G. Rochow, a skilled organic chemist at the Company's Research Laboratory, invented a "direct process" that greatly simplified the preparation of silicones from their chemical constituents. The silicones thus produced were a unique family of materials, bridging a gap between organic and inorganic substances and combining the benefits of these substances, such as thermal and environmental stability.

Out of these researches with the most common of substances — sand — came a versatile new family of materials called silicones and the first economical process for their production. In World War II, General Electric silicones were pressed into use in such ways as silicone rubber for gaskets that could withstand the heat of Navy signaling lamps and Army searchlights.

Aided by the application of the fluid-bed catalytic cracking process to silicone manufacture developed by Dr. Charles E. Reed, General Electric began commercial production of silicones with the opening of its plant in Waterford, N.Y., in 1947. Today, the GE Silicone Products Department is an international business turning out more than 2000 different products for the automobile, construction, electrical, aircraft and other industries. Its products include soles of the boots that made "one small step for mankind" when Astronaut Neil Armstrong became the first human to walk on the surface of the moon.

Superhard materials

Some of the most significant work at the Company has been in the field of superhard materials. The first of these was cemented tungsten carbide, which revolutionized the metal-cutting industry. GE's interest grew out of a 1925 trip that Dr. Samuel L. Hoyt of the Research Laboratory took to the Osram Lamp laboratories in Berlin. Subsequent work by GE researchers showed the potential of this "hardest metal made by man," and in 1928 GE formed the Carboloy Company as a subsidiary to develop a business out of these superhard materials. Today, cemented tungsten-carbide metals provide cutting tools that boost industrial productivity and contribute a major portion of the revenues of GE's Metallurgical Division.

These ultrahard metals made possible the tooling, punches and dies used in another notable GE advance — the synthesis of diamonds.

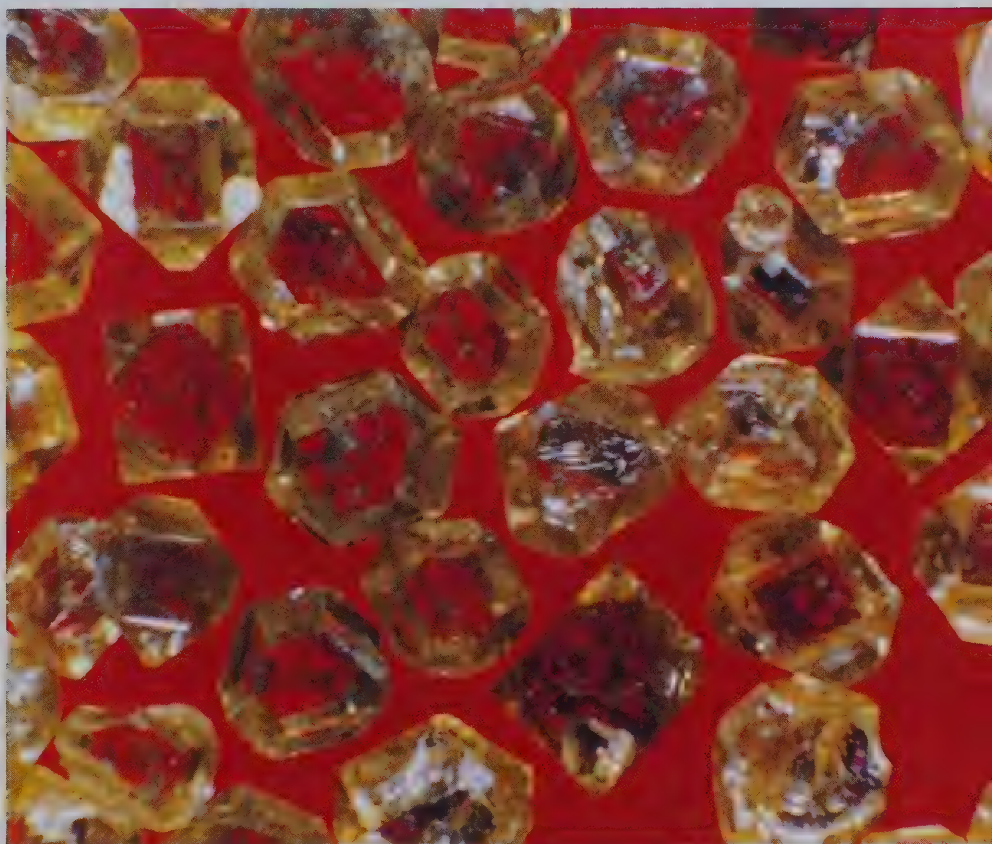
To bring this dream of the alchemists to reality, GE Research Laboratory scientists had to build pressure chambers that could operate at 1.5 million pounds per square inch — equal to pressures more than 100 miles below the earth's surface — and temperatures as high as 3000°C, nearly that of the surface of the sun. But by 1954 GE was able to produce identifiable diamonds and, in 1957, to bring out commercial Man-Made® diamonds that were clearly superior to mined diamonds for many applications ranging from metal cutting to glass grinding, and from stone sawing to dentistry.

Work with superpressures produced another result that has had large-scale commercial significance for General Electric. In 1957, Robert H. Wentorf of the Research Laboratory synthesized a material not found in nature — cubic boron nitride. Extremely high pressures and temperatures converted the boron nitride crystal from its hexagonal form to a cube. Named Borazon®, cubic boron nitride is surpassed in hardness only by diamond and has found extensive applications as a superabrasive for such jobs as cutting steels at high temperatures.

Development of engineering plastics

Another product of General Electric's never-ending search for better insulating materials came in the 1950s: Lexan® polycarbonate plastic — so tough it can be used as a substitute for metals in many applications, thus putting it in the category of "engineering plastics."

The Lexan story began with Dr. Daniel W. Fox who, in 1953, joined a Research Laboratory program to find an improved thin-film magnet wire insulating material. Seeking an insulation that would not be degraded by water, he decided to work with ma-



Today, General Electric conducts large-scale businesses in a wide range of silicone materials (above) and (right) in a variety of types of Man-Made diamonds.

terials that he had been unable, in earlier research, to break down by boiling water or steam. One of these was bisphenol-A, used in making epoxy resins. As he describes his experiment: "I tried it and started making a polymer by ester-exchange . . . and the melt became more and more viscous. Eventually, I could no longer stir it, and I stopped when the motor on the stirrer stalled. When the mass cooled down, I broke the glass off and ended up with a 'mallet' made of a semicircular replica of the bottom of the flask, with the stainless steel stirring rod sticking out of it. We kept it around the laboratory and occasionally used it to drive nails. It was tough!"

Further research on the substance, it was agreed, should be conducted. A program was set up. By 1958, a pilot plant was producing enough of the Lexan® resin for test marketing and field trials. Keeping up the momentum, GE started a full-scale plant at Mt. Vernon, Indiana, in 1959 and completed it in 1960, with a capacity of five million pounds per year. Production has since been increased many times.

While Lexan resin offered the important qualities of transparency and high impact resistance, another property that turned out to be highly important for industrial customers was its great dimensional stability — that is, its resistance to warping or changing shape under great stress. This property, plus its strength, enabled it to do many of the jobs previously reserved for metals.

General Electric added another major new plastic material in 1956 with the discovery by Dr. Allen Hay of an entirely new polymer material, PPO® (polyphenylene oxide), whose unique properties include unusual strength at high temperatures. Its commercial form, called Noryl® resin, has taken over many automotive and other applications.

The GE family of plastics was further broadened in 1971 by the introduction of Valox® thermoplastic polyesters offering special resistance to solvents, oil and gasoline along with high heat resistance. And the 1972 introduction of Engineering Structural Foam offered customers a variety of plastics with remarkable strength-to-weight ratios.

Materials — a major GE business

The road that began a century ago with the search for better electrical filaments, conductors and insulators has, through innovation, branched off in many directions and reached throughout the world. In terms of GE organization, what started with small groups of laboratory scientists has grown from Department to Division and, in 1977, to Group status.

The dimensions of GE's materials business are suggested by the volumes of products shipped. Production of plastics, as an example, exceeded 500 million pounds in 1977, a 20-fold increase over the 25 million pounds shipped just ten years earlier. More astonishing, General Electric has sold more than 50 tons of manufactured diamonds since launching this business in 1957.

Materials research continues on a large scale. In plastics, as an example, GE has already announced new generations of materials with superior properties. Beyond Lexan is XB-1®, a transparent resin whose outstanding fire resistance and low-smoke properties make it valuable for interior walls and ceilings of planes, trains and buses.

Similarly, beyond Lexan® sheet is MR-5000, a clear-coated product with an abrasion resistance approaching that of glass. And beyond Noryl are plastics extending this technology into higher heat ranges, greater flame retardance and increased strengths.

The pioneers: Willis R. Whitney

As he would make his rounds of General Electric's Research Laboratory that he started and directed for 32 years, Dr. Willis Whitney's typical greeting was not just "Have you solved the problem?" but "Are you having any fun?" Thus it was that Whitney set a pattern by which the researchers were assigned to projects in which they were most interested.

Graduating in chemistry from Massachusetts Institute of Technology in 1890, Whitney remained there as an instructor for four years, then went abroad to earn his Ph.D. from the University of Leipzig in 1896 before returning to M.I.T.

Before taking the GE post in September 1900, Whitney first had to be assured that he could still spend as much time as he felt was necessary on his research in colloid chemistry. Three years later, however, he decided that the work at GE was important enough to give up his connection with the university.

Whitney is widely credited with his innovative approach to the administration of a scientific research facility. He would sometimes invite a group of young researchers to lunch, for example, take a bit of some material out of his pocket, and get them to talk about it. In that way he often found out enough so that he could later assign projects to them that suited their interests and temperaments. What is often overlooked about Whitney, however, is the fact of his own abundant contributions to scientific developments such as the GEM metallized carbon lamp that was the leader in lighting technology for many years.

Tough engineering plastics have become a General Electric specialty. GE Lexan plastics are strong enough to replace metals in many applications. And, as shown at right in the covering of a pedestrian ramp leading to New York's Yankee Stadium, Lexan sheet replaces glass with a clear material that is virtually unbreakable.

8. Technologies for air and space

Shrouded by World War II secrecy, a small glider-like aircraft taxied to the end of a runway on a dry California lake bed, throttled up and gathered speed for its ten-minute flight that began the jet age in the United States. The date: October 2, 1942.

The two jet engines that powered that first American jet, the Bell XP-59 Airacomet, were General Electric I-A turbojets, each developing 1250 pounds of thrust. Since then, General Electric has developed engines more than 50 times as powerful as the first I-A jet engines.

Preceding the I-A was a story of progress that began in 1901, when GE successfully tested the world's first steam turbine. In 1903, GE scientist Dr. Sanford Moss operated the first gas-driven turbine wheel in the United States — an experiment that contributed to the first flight of an airplane with a turbine-powered supercharger enabling it to fly higher and faster. By 1939, this GE propulsion device helped a Boeing B-17 set a cross-country flight record of nine hours, fourteen minutes.

During World War II, with jet-powered aircraft already flying in Germany, the Allies looked to the United States for development and production of a jet engine designed by England's Frank Whittle. The U.S. War Department selected General Electric as the one company that had the knowledge of mechanics, chemistry and metallurgy, as well as experience with turbines and turbine-powered superchargers, to take over U.S. jet engine development.

After the Bell XP-59 flight in 1942, work continued throughout 1943, and the Army Air Corps liked the test results so well that they called for production of jet aircraft in volume.

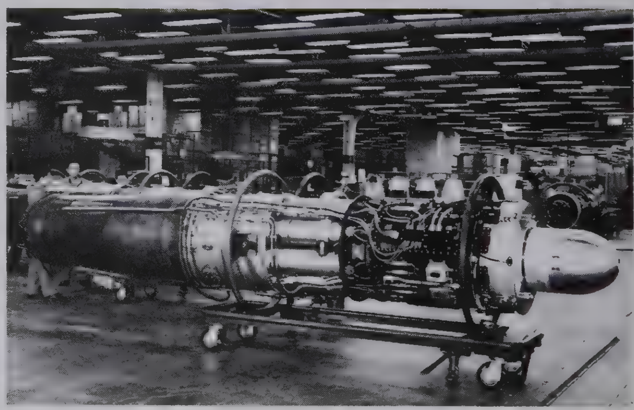
A number of variations in the basic motor design culminated in the I-40, designated the J33 by the Air Corps, in 1943. And, early in 1945, the War Department announced the new Lockheed P-80 Shooting Star, first Air Corps operational jet fighter, powered by the J33 engines. With a top speed of more than 600 miles per hour, it was faster than any plane ever flown by either side in the war.

Not long after the war, the General Engineering Laboratory's Flight Test Division set up a facility at the Schenectady County Airport for testing not only engines but also airborne radar and other aircraft equipment — developments that provided the base for General Electric's present-day businesses in aerospace instruments, controls, and electrical and electronic systems.

Supersonic powerplants

As the military continued to step up its design and

An increasingly familiar sight (right) to air travelers is the GE symbol on the flanks of engines powering today's advanced jet airliners — including the McDonnell Douglas DC-10, the A300 Airbus and many Boeing 747s.



U.S. jet flight has its roots in GE work on turbosuperchargers that enabled a LePere biplane to set a new altitude record of 18,400 feet in 1919. First U.S. jet plane, the GE-powered Bell XP-59 jet of 1942, put GE in the business of building aircraft jet engines.

performance requirements for engines that were mechanically simple, low in weight, and still powerful enough to power aircraft to twice the speed of sound in combat, GE brought out its J79. This remarkable engine was a military "workhorse" applied to many new planes. In 1958 it enabled a Lockheed F-104 Starfighter to set seven world time-to-climb records. Used also in the Convair B-58 Hustler, the McDonnell F-4 Phantom II and the North American A-5 Vigilante, the J79 helped aircraft to set 44 world records for time-to-climb, speed and altitude.

GE during the 1960s concentrated on a range of military powerplants. These included new, more powerful engines for fighters and bombers, engines to power the Air Force's experimental XB-70 at three times the speed of sound, and powerplants for vertical take-off craft.

The Company launched a helicopter engine demonstration program for cutting engine weight by 40 percent and fuel consumption by 20 to 30 percent. At about the same time, in 1965, General Electric won the contract to build engines for the Lockheed C-5 transport, the world's largest aircraft, and developed the high bypass turbofan TF39 engine.

In 1968, building on its commercial experience with business jet engines, GE entered the commercial airline market with its CF6 engine, which became the powerplant for the highly successful McDonnell Douglas DC-10 trijet wide-bodied airliner. An increased-thrust version, called the CF6-50A, was the choice for the European-built A300 Airbus, as well as for new DC-10 Series 30 trijets. Subsequently the engine was also specified for a number of Boeing 747 aircraft.

In its Centennial year, General Electric serves as a major supplier of both military and commercial engines. GE powerplants have been chosen for new generations of military craft, from Army helicopters to Navy submarine detection planes. GE CF6 engines are in service with over 50 airlines throughout the world. And in cooperation with the French aircraft company SNECMA, General Electric is developing the CFM56 engine to enable 120- to 160-passenger aircraft of the '80s to meet noise regulations while reducing fuel consumption significantly.

Reaching for the moon

In November 1944 General Electric scientists were sent to Europe to study captured German V-1 rockets, as the start of a research program on guided missiles. The scope of the research was expanded in 1945 and 1946 to develop new rockets that would surpass the German V-2s in speed, distance and accuracy.

In the late 1940s General Electric conducted the Hermes Project for the Government, in which GE and German scientists built and tested rocket engines at White Sands, New Mexico. During the ten years that the project was in existence, they tested 103 rockets and missiles, developed the first multistage liquid propellant rocket, and built liquid-fuel motors that led later to the nation's Atlas and Titan rockets.

The Air Force selected GE in 1955 to develop the re-entry system for the free world's first intercontinental ballistic missile, the Atlas. The Company developed a copper re-entry shield that would absorb and dissipate the heat when a missile came into the atmosphere, and shortly thereafter an ablation shield of a carbon phenolic material that protected the spacecraft by disintegrating and, in the process, absorbing enormous quantities of heat.

Over the next few years GE became a major contributor to the nation's ten highest-priority missile programs. GE was also a producer for the guidance

The pioneers: Sanford A. Moss

In 1903, Dr. Sanford A. Moss was years ahead of his time when he wrote his Cornell Ph.D. thesis on the gas turbine. While the idea was conceptually sound, materials then available weren't strong enough at high temperatures to withstand the stresses in Moss's turbine, so he put aside his design and went to work for General Electric.

Working with Charles Steinmetz and Elihu Thomson, Moss first concentrated on centrifugal compressors used in blast furnaces and then on steam turbine development. The experience he gained in these fields was recognized during the first World War by the National Advisory Committee for Aeronautics, which asked him to find a way to give military planes more power. Dr. Moss's solution, worked out with the cooperation of the U.S. Air Corps, was the turbosupercharger — a unique turbine-type compressor.

On June 19, 1918, Moss and his associates ascended Pikes Peak with a 350-horsepower Liberty engine in tow in order to test his turbosupercharger. The new device attached to the reciprocating engine was designed to boost power by compressing air into the intake, allowing the engine to "breathe" normally even in the thin air at 14,019 feet. His turbosupercharger was a success. In the '20s, '30s and '40s, it helped establish aircraft altitude records and played a major role in World War II.

As for the industrial gas turbine, it waited until after World War II when General Electric engineers combined metallurgical developments with new jet engine technologies to turn Moss's dream of some 40 years earlier into reality.

system of the Navy's air-to-air Sidewinder missile. The Missile and Space Division was involved with the first payload recovery from space in 1958; the first vehicle recovery and the first photos from space in 1959; the first satellite recovery from orbit in 1960; and the first transmission during the radio blackout period of re-entry in 1961.

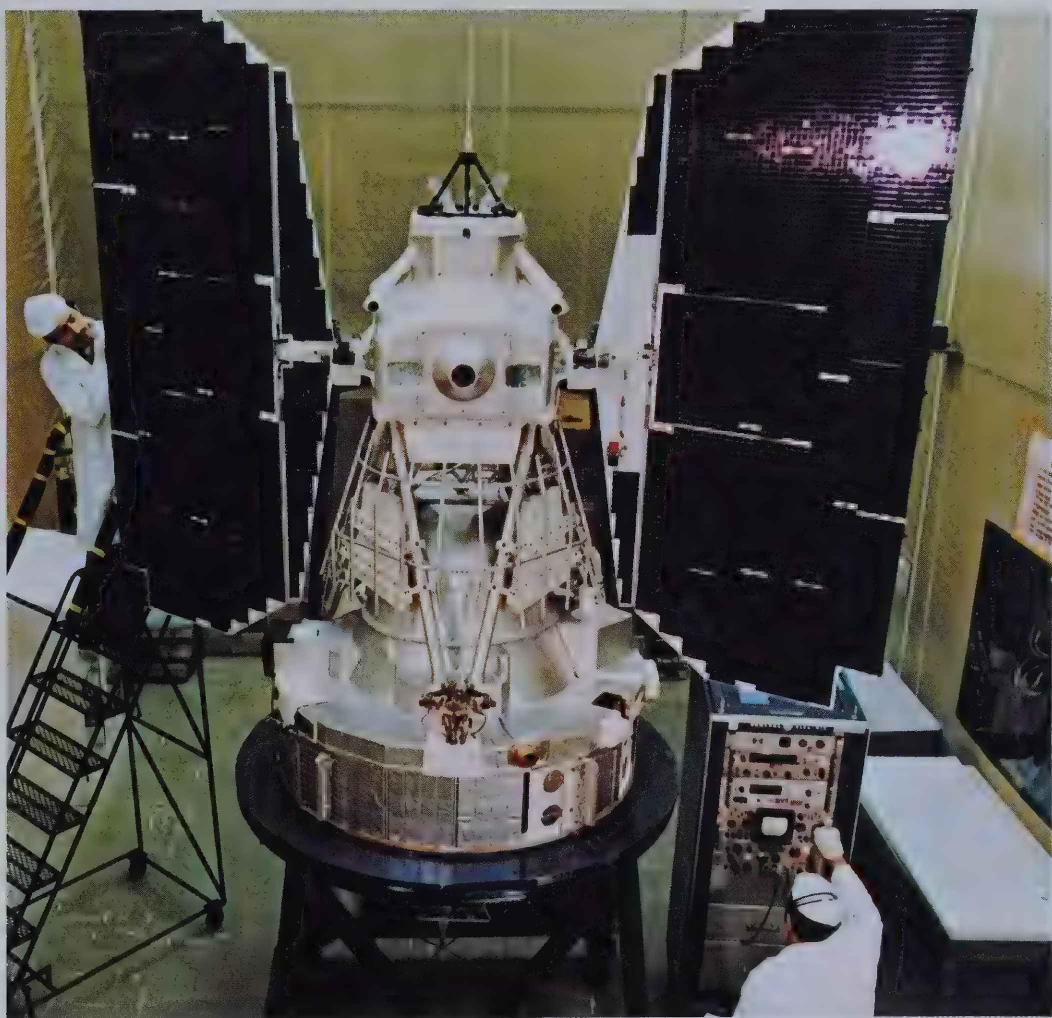
General Electric helped to pioneer the nonmilitary uses of space. The first GE Nimbus weather satellite was orbited in 1964, and was succeeded by five more over the next ten years. These satellites were responsible for development of much of our modern weather forecasting technology, as well as advance warning of the devastating hurricane Camille in 1969.

Another GE information gathering satellite is Landsat which regularly provides valuable information on the earth's most vital resources. Landsat 1 was to furnish data for a year, but continued for more than five years. Landsat 2 and 3 are also in orbit and GE is building a fourth, more advanced Landsat for 1981 launch.

For Project Apollo, which in 1969 put man on the moon for the first time, 37 separate GE operations and 6000 employees made contributions that ranged from primary responsibilities to supplying parts. As a prime contractor for Apollo, GE had a wide range of duties that included responsibility for overall systems reliability, checkout and engineering support. In the flight of Gemini V and in six subsequent Gemini missions, GE-built fuel cells served as electric power sources aboard the spacecraft.

General Electric continues to be a leading aerospace contractor, designing and producing advanced communications satellite programs for the American and Japanese governments as well as contributing to scientific space exploration projects such as the Pioneer Venus probe. Today, some of the most promising long-term projects being conducted by GE, however, are in the earthbound offshoots of its space work. Prominent among these is solar energy research, including development of equipment for solar heating and photovoltaic systems to convert sunlight directly into electricity.

GE work in space began with the Hermes Project (below), experimenting with captured German rockets after World War II. Today GE is among the leaders in advancing space technology, as exemplified by the Landsat spacecraft shown during test at GE's Valley Forge, Pa., space facilities.



9. GE in the home

With electric lamps taking over the lighting of most American homes, General Electric began early to offer other home products, including fans and toasters.

But the first electric appliance to be widely accepted was the "Hotpoint" iron developed by Earl Richardson, a meter reader for the Ontario Power Company in California. Believing that electric power companies could sell more power and lower their rates if enough daytime uses for electricity could be found, he handed out a number of irons to his company's customers on a trial basis and convinced the company to generate daytime electric power each Tuesday, the traditional ironing day. The experiment worked so well that Richardson left his job in 1905 and formed his own company to manufacture the new irons.

The next year, in response to a suggestion from his wife that the iron needed more heat at the tip for pressing around buttons and into pleats, he redesigned the iron with heating elements that converged at the tip, and loaned samples to local laundresses. They liked the "iron with the hot point" so much that they refused to return the samples. Hence the name "Hotpoint".

Cooking with electricity

At about the same time, George Alexander Hughes, founder of an electric power company in Fargo, North Dakota, also recognized the value of increasing daytime use of electric power. He developed an

Electric kitchen of the 1930s featured a GE "Monitor Top" refrigerator, a Hotpoint® range, a GE clothes washer and a variety of GE housewares to make life easier for the homemaker.

Today's GE kitchen and laundry are more colorful as well as more convenient. Push-button controls on the washer and dryer give homemakers more options. Kitchen features include refrigerator-freezer with through-the-door ice and ice water, a Potscrubber® dishwasher, trash compactor, range with self-cleaning oven, and a built-in microwave oven.

The wide spectrum of GE housewares extends from work-easing irons and more capacious Toast-R-Oven® toasters to electronic digital scales and clocks, new hair stylers, food processors and coffeemakers.

And behind it all is GE's service network that includes radio-dispatched appliance and TV service in 131 cities from Maine to Hawaii, plus a nationwide housewares service system.

electric range — a crude model with open wires set into clay bricks as the heating elements — and demonstrated it in 1910 at a meeting of the National Electric Power Association in St. Louis. Hughes obtained enough orders to found the Hughes Electric Heating Company in Chicago to manufacture his ranges.

Meanwhile, General Electric had introduced an electric cooking device in 1906, consisting of a wooden table with an elevated back on which were mounted switches and a number of retractable cords which plugged into individual electrified utensils used for grilling, frying and boiling. On a platform underneath the table was an oven.

A 1918 merger joined the heating device section of General Electric with the Hughes Electric Heating Company and the Hotpoint Electric Company to form the Edison Electric Appliance Company. The Edison company's 1919 catalog listed — in addition to electric ranges and three types of Hotpoint® irons — radiant heaters, foot warmers, bake ovens, chafing dishes, electric percolators, electric hotplates, griddles, tea kettles, water heaters, vacuum cleaners and sewing machines.

Arrival of the "Monitor Top"

Recognizing the opportunities offered by the increase in electrically-wired homes, GE's President Gerard Swope and Chairman Owen D. Young channeled more resources into appliances during the 1920s — a move that brought significant rewards during the otherwise depressed years of the 1930s.

In 1927, GE's Electric Refrigeration Department began production of the "Monitor Top" refrigerator with its mechanism hermetically sealed in steel. The refrigerator derived its name from the round compressor unit atop the cabinet. It was the first refrigerator that the average person could afford — and today, more than 50 years after their introduction, a number of the old "Monitor Tops" are still in service.

The modern electric range era really began in 1929, when Hotpoint introduced the highspeed Calrod® heater surface unit. And building on its success with ranges and refrigerators, GE brought out an array of major appliances during the Depression years: clothes washer in 1930, dishwasher in 1932, room air conditioner in 1934, and the industry's first food waste disposer in 1935. In that year, GE also installed heat pumps for year-round heating and cooling in two utility company locations as a test.

The postwar surge in appliances

During World War II, GE appliance factories were converted to wartime production, turning out electrical fittings for ships, rocket components, and the famed "bazooka" rocket launcher.

With consumer demand exploding after the war, both General Electric and Hotpoint announced a wide variety of new and improved products, such as the first automatic clothes washer and two-door refrigerator-freezer in 1947.

The Company's housewares line had also expanded to include travel and steam irons, as well as such food preparation products as skillets, coffeemakers and waffle irons.

Postwar demand for major appliances soon strained GE's aging manufacturing facilities. In 1950, the Company bought 922 acres of farmland just outside Louisville, Ky., as the site for its Appliance Park, which by 1957 was producing the full line of General Electric major appliances and was recognized as the world's largest and most efficient appliance plant.

In 1954, the Mobile Maid® portable dishwasher was introduced. And in 1955, General Electric broke the monotony of all-white kitchens and laundries — and scored an industry first — by introducing a full line of appliances in a varied palette of colors.

The revolutionary P-7® self-cleaning oven was announced in 1963. In developing the oven, which uses a pyrolytic system to remove food soil, GE engineers were granted some 100 patents.

The General Electric and Hotpoint major appliance businesses were brought together under com-

mon management, but with competing sales forces, in 1967.

In housewares, the '50s and '60s saw the introduction of the first Toast-R-Oven® toaster, General Electric's entry into the portable hair dryer business, and the marketing of the electric slicing knife — an industry first.

Products for the '70s

GE's countertop microwave oven made its debut in 1971. This was the same year that GE and Hotpoint trash compactors and compact clothes dryers, and the GE compact clothes washer, came to market. In 1972, GE introduced the Carry Cool® room air conditioner which weighed only 43 pounds. And in 1977 a new spectrum of colors for General Electric and Hotpoint appliances was announced.

The Weathertron® heat pump, completely redesigned during the mid-1960s, increased its share of the home heating and cooling market dramatically during the 1970s; heat pumps are now being installed in almost 20% of new homes.

The 1970s also saw the marketing of many new housewares products, including self-cleaning irons, food processors and home smoke alarms.

As appliance production expanded, so too did the Company's product service capabilities. Service for GE and Hotpoint major appliances and GE television is now performed by Company employees in 131 cities, and by independent franchised servicers in smaller towns and rural areas.

Technology for tomorrow

Responding to the need for energy conservation, many General Electric and Hotpoint appliances are significantly more energy-efficient today than those being marketed only a few years ago. Progress toward greater efficiency is expected to continue as GE engineers and scientists develop the technology needed to make further advances in the 1980s.

The use of electronic controls on appliances is another area of active development. These more sophisticated controls will bring new capabilities and convenience to many automatic appliances.

Despite the fact that high percentages of electrically-wired homes in the U.S. are already equipped with such products as refrigerators, washers and electric irons, there is no letup in the pressure on GE consumer goods technology. Further innovations are needed to help GE compete in the industry's huge replacement market. New developments in timesaving appliances are spurred by increases in the numbers of working women and two-career families, as well as by other changes in lifestyle.

And beyond the U.S. are people all over the world who are reaching out for the labor-saving products that have become commonplace in the United States. This international demand for electrical living is creating markets both for exports of U.S.-made appliances and housewares and for the products of GE affiliates manufacturing consumer goods for the markets in their host countries.

New areas of advancement and growth for General Electric are, left to right: microwave ovens that include this countertop model; GE's Widescreen 1000 color TV with a picture three times the size of a 25-inch diagonal console; and the Weathertron heat pump, for all-electric heating and cooling.

10. GE technology and the future

The industrial research laboratory was, in itself, a General Electric invention. Before 1900, industry had laboratories, but they were for development and testing, not for the seeking of new scientific knowledge.

Several GE people arrived almost simultaneously at the realization that engineering progress in the 1890s was based on the researches of Faraday, Henry and other scientists in the early part of the century. They could see that unless new research produced new scientific discoveries, engineering development must inevitably slow down or grind to a halt.

The decision to establish a General Electric research laboratory was shared by three men who have figured prominently in this report — Edwin W. Rice, Jr., Elihu Thomson and Charles Steinmetz — and by the Company's patent lawyer, Albert G. Davis. They agreed on the need and on the choice of Dr. Willis R. Whitney to head the new laboratory.

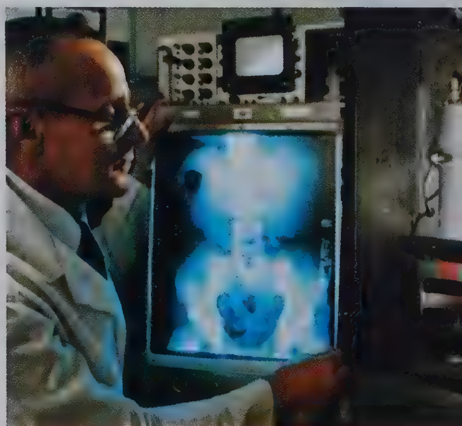
Where to house it? Steinmetz had a barn behind his home that he was wont to use as a retreat when he had technical problems to ponder. There the laboratory was set up and Dr. Whitney moved in as the first director of research for General Electric.

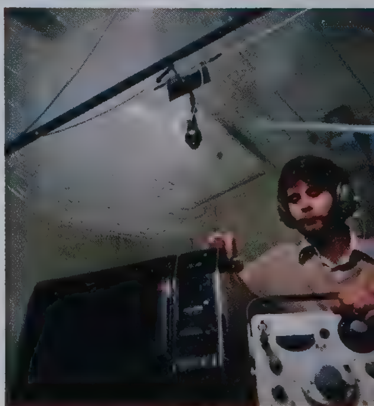
The understanding was that Whitney was to keep his professorship at the Massachusetts Institute of Technology and divide his time between the laboratory and the university, on the premise that there was just not enough industrial research to require his full efforts. But in 1901 Whitney wrote, "I spend four days each week in Boston . . . and three days in my new laboratory. Two nights a week I sleep on the railroad. It's all very fine, but somewhat wearing, for it looks to me as if there was a week's work at both ends of the line." After three years Whitney moved his family to Schenectady and made the laboratory his full-time job, one he retained until his retirement in 1932.

Whitney established many of the Laboratory's traditions, including that of research directors who, themselves, contribute basic scientific advances as well as managerial leadership. Whitney's own contributions, and those of Dr. Coolidge, his successor in heading the laboratory until 1945, have already been reported. Dr. C. Guy Suits, who served as research director until 1965, made basic discoveries in electrical arc phenomena that have proved useful in improving protective equipment for electrical systems. Among the contributions of Dr. Arthur M. Bueche, who led GE research from 1965 to 1978, is a method of cross-linking polymers that has led to improved insulation for wires and cable.

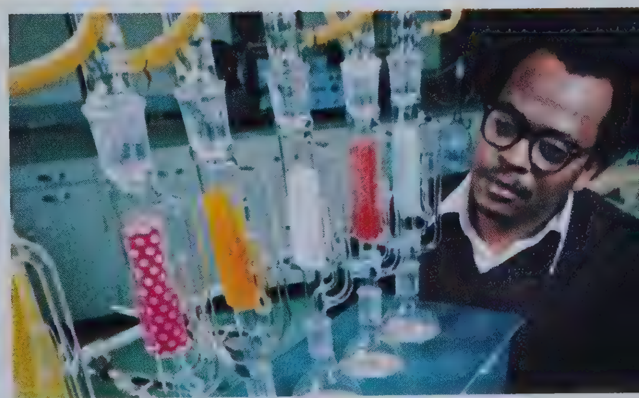
Over its 78-year course, GE research has risen from a backyard barn to an expanded Research and Development Center occupying campus-like surroundings on the Mohawk River in Schenectady. It has grown from a one-man part-time activity to a diverse R&D program employing some 800 scientists and engineers, plus a supporting staff of nearly

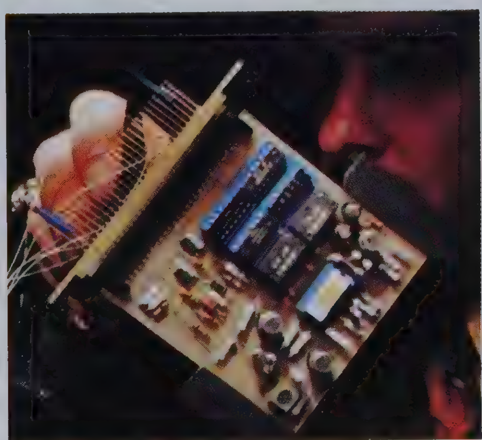
The physical setting for General Electric's research laboratory has changed from a barn behind Steinmetz' home in 1900 to the campus-like surroundings of the Research and Development Center overlooking the Mohawk River in Schenectady, N.Y.





Advancement of GE technology is the focus for more than 15,000 scientists and engineers and more than 100 laboratories. Examples: work on new medical equipment, microwave ovens, screw-in fluorescent lamps, electronic circuitry, power delivery apparatus, clothes washers, semiconductor materials and heat pumps.





1200. It has moved from an experimental status to a record of achievement that underlies many of the Company's products and businesses; that has added immeasurably to scientific knowledge, and that has yielded incalculable benefits to society.

'Centers of Research'

Yet some 90 percent of General Electric's total R&D is done not by the Research and Development Center but by GE operating components and by the more than 100 laboratories associated with them.

General Electric has a program to maximize the Company-wide benefits of this far-flung R&D network. Corporate Research and Development identifies and designates "Centers of Research" in GE operations — groups with special skills and facilities which are judged to be highly useful not only to their own sponsors but also to other parts of the Company.

The types of expertise thus identified and offered on a Company-wide basis cover a range from semiconductor technology to high-voltage a-c transmission phenomena. The objective is synergism — to make the whole of GE's developmental effort greater than the sum of the component parts.

Fresh starting points

"Discoveries and inventions are not terminals," Dr. Whitney once said. "They are fresh starting points from which we can climb to new knowledge."

To survey the fresh starting points deriving from present-day research and development is to gain a sense of the future that technology will help to shape. A survey of GE work in four crucial areas — energy, new materials, new electronics and medical technology — was recently led by Dr. Charles E. Reed, who for many years guided the development of General Electric materials businesses before becoming the Company's first Senior Vice President for Corporate Technology.

Appropriately, he noted, a substantial share of General Electric's total effort is devoted to some form of energy research and development. Sample projects include:

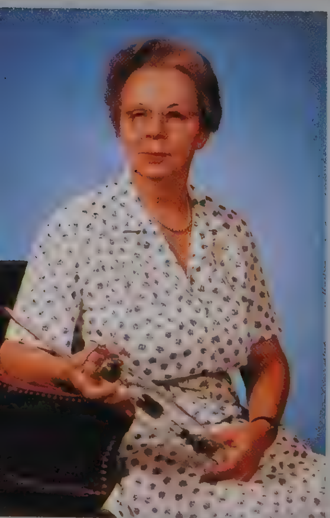
- *Clean gas from coal.* "A pilot-plant coal gasification plant at Schenectady is successfully converting more than three-quarters of a ton of coal per hour into 100,000 cubic feet of gas suitable for the STAG (steam-and-gas combined-cycle power generation) system."
- *Superconducting generators* operating at temperatures near absolute zero. These power sources "can be perhaps only a third the size of conventional generators, making it possible to factory-assemble and ship units with higher ratings than the huge machines we make today."
- *Electric vehicles.* While GE does not plan to enter the auto business per se, the Company foresees a growing role as a leading manufacturer of electric motors, solid-state electronic controls, batteries and other components. General Electric is participating in a Department of Energy project to construct two experimental four-passenger electric automobiles with an urban range of 75 miles before recharging and speeds of up to 55 miles per hour.
- *Sodium-sulfur batteries* are foreseen as devices with the energy-storage capacity to store utilities' output in slack periods in order to help meet peaks in electrical demand.
- *Solar heating* developments are being pursued by General Electric on a number of fronts but, in Dr. Reed's view, "to effectively use the sun's energies for anything other than heat will require a truly major scientific breakthrough."

The search for better materials continues to be a highly active area of GE R&D. A particularly promising example: "amorphous" metals, produced when molten metals are cooled as much as a thousand degrees in a thousandth of a second. These "provide absolutely remarkable magnetic properties at potentially low costs and could revolutionize the future

The pioneers: Katharine B. Blodgett

In a very *special* way, Katharine Blodgett was a pioneer — she became the first woman Ph.D. on the staff of the GE Research Laboratory.

She joined the Laboratory in 1918, after receiving a B.A. in physics from Bryn Mawr, at the age of 19, and an M.S. from the University of Chicago.



Assigned to Dr. Irving Langmuir as a research assistant at General Electric, she worked with him on experiments and collaborated with him in writing papers for technical journals.

In 1924, she took a leave of absence to become one of the few women students at the Cavendish Laboratory of Cambridge University in England. Two years later, she received the first Ph.D. in physics ever awarded to a woman by the university.

Her worktable in Dr. Langmuir's laboratory was waiting for her when she returned to General Electric in Schenectady, and she worked with Langmuir in his studies on the use of tungsten for lamp filaments.

One of Dr. Blodgett's more newsworthy accomplishments was the development, in 1938, of a nonreflecting "invisible" glass — prototype of the coatings used today on virtually all camera lenses and optical devices.

During World War II, she tackled the problem of ridding airplane wings of ice. She also devised a faster, denser smoke screen than that provided by the simple smudge pots in use at the time.

And in the late 1940s, she performed research for the U.S. Army Signal Corps on use of thin films for the development of a humidity-measuring device to be carried into the upper atmosphere by weather balloons.

design of motors, transformers and other basic electrical products."

"The new electronics," based on spectacular reductions in unit costs, is being applied throughout General Electric in such ways as new controls and displays for appliances, new TV projection systems for the home, improved microwave ovens and sophisticated new automatic meter reading and control systems.

The combination of traditional x-ray and new computer software technology, which has already produced the amazing new computed tomography machines, promises cross-sectional views of the human heart in action. "We can only try to imagine," according to Dr. Reed, "what this can mean to the study of heart disease, which remains the greatest killer of them all."

Into GE's second century

Here in General Electric's Centennial year, GE research and development has become a billion-dollar-a-year range of activities, including GE-funded R&D as well as that performed under contract, primarily for government agencies.

One measure of the depth of GE research and development is provided by Government patent awards. If these are accepted as impartial judgments of inventors' creativity, General Electric has developed nothing less than the most technologically creative enterprise on the business scene. The number of patents granted to GE inventors — almost 50,000 patents over the course of GE history and nearly 1000 annually in recent years — is higher than that for any other company.

But GE scientists and engineers do not invent for the sake of building a statistical record. Spurred by the competitive needs of their Company's diverse businesses, GE technologists drive to keep this major worldwide enterprise on the forward edge of technological change, knowing that technical excellence is the key to winning new business in markets around the world, maintaining the jobs of GE employees and providing growth in earnings for GE share owners.

General Electric's 15,000 technical-degree holders engaged in science and engineering, plus an equal number of manufacturing, sales and service engineers, have shaped a case history that demonstrates admirably the real fruits of technology: fresh solutions to problems facing humankind and a steady strengthening of the material fabric of society, freeing men and women to spend increasing segments of their time not only in leisure pursuits but in creation and enjoyment of the arts and in the advancement of the quality of life.

The 1932 Nobel Prize for chemistry was presented to GE scientist Dr. Irving Langmuir, right, by King Gustavus V of Sweden. The award was the first to a scientist employed by an industrial laboratory.

Dr. Ivar Giaever, left, of the GE Research and Development Center was presented the 1973 Nobel Prize in physics by King Carl XVI Gustaf. Dr. Giaever shared the award with Leo Esaki and Brian D. Josephson.

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Extra rack space. People just like you helped us get it.
Our engineers tested 395 Potscrubber III dishwashers with GE employees. They confirmed that dishwasher capacity is important. Our Super Rack gives you the capacity you need—even to wash stemware upright.

Lab teamwork gave us an interior that won't chip, crack, peel or rust in normal use.
We call it Permatuf®. A material so rugged, we put a special warranty on it. It took the efforts of our researchers in Louisville and Schenectady to pioneer...and perfect it.

An exclusive filter design. Pooling our knowledge with other GE appliance technologies made it possible. How effective is the filter? There's no need to pre-rinse. Coupled with the soft food disposer, the Potscrubber III has the finest General Electric wash system ever produced.

A spray arm ahead of its time. We combined years of dishwasher expertise with computer science to get there.
The Multi-Orbit™ wash arm. Every time it turns, the wash pattern is different. The secret's in the offset center of rotation and nozzle pattern design—a computer-aided development. It helps you use less water without less washing.

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GENERAL ELECTRIC

INVESTOR

Winter 1978

GE's Centennial celebration:
key customers meet 'Tom Edison'

In 1878 there were about 48 million people in the United States, three out of four of them living on farms.

In many towns the lamplighter made his evening rounds, lighting the gas lamps. But in most homes the kerosene lamp, or even the candle, burned.

Homemakers used tubs and washboards to clean their families' clothes, cakes of ice to refrigerate food, and open fireplaces to ward off winter's chill.

"Urban transit," then, meant horses — over 100,000 of them pulled trolleys in the U.S. alone.

In industry, steam was king — interiors of factories were a hazard of belts and pulleys connected to central shafts turned by steam engines.

But in that year, in Menlo Park, New Jersey, Thomas Alva Edison, a young man of 31, determined to invent a practical electric light. On October 15, with the financial backing of a small group of investors, he established the Edison Electric Light Company.

Edison's successful invention of the incandescent lamp, a year later, spurred the growth of his company and launched a new era for humankind — one in which electrical technology took over the lighting of homes, the lifting of burdens, the power for transit, the energy for industry.

GE people have made the Company's Centennial year more than a time for remembrance.

As Edison's successors, the people of General Electric have approached the observance of this Centennial year as a moment of pride, but also as an occasion to strengthen their Company in all its dimensions.

The planning that preceded the Centennial celebration had as its goal not only a rich remembrance of things past but a renewed recognition of the rewarding tasks that await the Company in the century ahead.

Two Centennial committees were formed: one, at the operating level, to stimulate and mesh the programs developed independently by each business Group; the other, chaired at the corporate level by Vice Chairman W. David Dance, to review and coordinate both operating and corporate programs on a Company-wide and worldwide basis.

Special programs have sought to strengthen GE in all its dimensions.

Here at the 1978 year end, following the October peaking of Centennial activities, the results of these efforts are evident:

• General Electric has given special recognition to its customers and community associates. In 29 cities across the U.S. and Canada, more than 16,000 representatives of customer companies, community organizations and government agencies have joined in Company dinners hosted by GE's vice presidents in charge of regional relations. Highlight of these dinners has been the one-man show, "Thomas Edison: Reflections of a Genius," featuring in-person appearances by actor Pat Hingle as an elderly Edison genially reminiscing about his life.

• In many other cities, additional thousands of community neighbors have attended GE Open Houses whose programs have included a filmed version of the Edison-Hingle show. Foreign language versions were prepared for use in overseas locations.

• General Electric has enabled its 560,000 share owners to participate in the celebration through a Centennial issue of the GE *Investor,* distributed in September, and special events at the 1978 Information Meeting, as reported on pages 4-9 of this issue.

• For General Electric's 390,000 employees throughout the world, the Centennial observance has provided the occasion for an outpouring of varied and imaginative responses, as indicated on pages 10-11.

• To mark the Centennial year, General Electric's Research and Development Center sponsored a two-day symposium on "Science, Invention and Social Change," as reported on pages 12-13, which drew together some 172 technical leaders from all over the world.

• Over 50,000 junior-high minority students have in 1978 toured Expo-Tech, a motivational exhibit sponsored by GE to support the Program to Increase Minority Engineering Graduates, as reviewed on page 14.

• One way in which the general public shared in the Centennial observance was by viewing the "GE All-Star Anniversary," a two-hour celebrity-packed show, with John Wayne as host, aired on ABC-TV September 29.

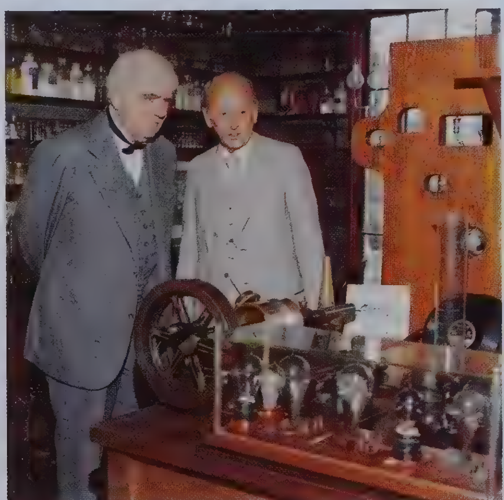
• GE's Centennial year has been recognized in the U.S. Congress. A commemorative resolution was passed in the Senate at the behest of Connecticut's Senator Abraham A. Ribicoff, while Connecticut's Representative Stewart B. McKinney introduced a similar resolution in the House.

• And, to foster a better international understanding of business, a Centennial grant was made to the American Assembly of Collegiate Schools of Business. The Assembly, in turn, sponsored a symposium on "Business and International Education" at George Washington University, attended by some 250 professors of business. Seven regional workshops made the symposium's materials available to additional numbers of educators.

Centennial programs included elements of lasting value as well as moments of fun and festivity.

Vice Chairman Dance has summed up the Centennial year's short- and long-term effects: "The celebration of General Electric's hundredth birthday included elements of lasting value as well as moments of fun and festivity. Benefiting from the breadth of the participation and the enthusiasm of the responses, General Electric embarks on its second century strengthened in spirit and in the revitalization of many of its key relationships."

Portraying Tom Edison, actor Pat Hingle appeared at GE customer dinners across the country and, below, at the restoration of Edison's Menlo Park Laboratory in Greenfield Village, Dearborn, Mich.



GE people are aiding in restoration of Louisville house where Edison lived as a typographer.

Share owners at 1978 Information Meeting hear their Company characterized as 'an enterprise at the leading edge of technology, management and social change.'

GE's 1978 Information Meeting provided opportunity for New York area share owners to participate.

Observance of GE's Centennial year gave a special flavor to the meeting, as interpreted by sketch-artist Stan Hunter.

At the 1978 Information Meeting of GE share owners, held October 5 in New York City, General Electric sat for its Centennial portrait.

GE at 100, as described by Board Chairman Reginald H. Jones, "is a complex enterprise that has evolved from Edison's little venture in Menlo Park." Most observers would agree, he said, that "General Electric fits in no neat category. It is a multi-product, multi-market, multi-national firm that long ago spilled over the confines of electrical manufacturing into related technologies and industries. Yet it is not simply a random collection of businesses. You could not 'put together' a General Electric Company today by buying up the assets of other companies. Rather, General Electric is a product of its own history, shaped and tempered by time and experience. It is also a *maker* of history, a thrust into the future, and what has been called 'a precursor of the socially responsive corporation of tomorrow.' "

Chairman Jones, along with Vice Chairmen W. David Dance and Jack S. Parker, took turns filling in GE's anniversary profile in their talks to more than 1,000 share owners at Felt Forum in New York's Madison Square Garden.

Three managerial objectives

In this Centennial year, Chairman Jones told the share owner audience, "we have reexamined our capabilities and opportunities and set our course by three managerial objectives":

- Sustained earnings growth at a higher rate than the growth of the U.S. gross national product. Contrary to some analysts' predictions that a company as widely diversified as General Electric will grow only as fast as the total economy, GE managers "aim to do better than that by means of our strategic planning system."
- A productive environment for employees, recognizing that GE's "most indispensable resource is its very special people: a worldwide community of talented men and women with an enormous range of professional skills and disciplines — technical, financial, marketing, managerial — perhaps the most diversified collection of knowledge and talents in the industrial world."
- Socially responsive performance that earns and deserves the continued support of the public. "We strive to be good citizens, complying with the law and the ethics of the societies we serve around the world," Chairman Jones said. "But we want to do more than that. We want to continue to be a wellspring of progress for people, as we have in the past."

The business of generating businesses

"There is one main thread," GE's Chairman noted, "that goes through all our Company's history: we turn technology to the uses of society."

In its beginnings in 1878 as the Edison Electric Light Company, General Electric "was formed to finance an invention, and it is still inventing. General Electric has led the list of companies receiving U.S. patents every year since records have been kept. Over the years, GE inventors have been granted more than 50,000 patents, and they are still producing almost a thousand a year, nearly four patentable inventions every working day."

But an invention is worthless, he pointed out, "without the next step in the cycle — innovation — by which an invention or new idea is developed and marketed as a product that is useful to people. It is this process that turned Mr. Edison's little lightbulb company into the General Electric of today with revenues approaching $20 billion a year."

If GE managers were asked what business the Company is engaged in, Chairman Jones noted, "we would have to say that we are fundamentally in the business of generating new businesses — and new sources of earnings — from our emerging capabilities. Our future, as our past, lies in the continuous extension of our capabilities into new applications, new markets, new products and services, and into new or contiguous industries where we can make a contribution that is profitable


GE
100

to our share owners and profitable for the societies we serve."

Areas of opportunity for GE singled out by the Chairman and Vice Chairmen included:

- The energy revolution. "More, not less, of the total energy used in the world in the future will be in the form of electricity," Vice Chairman Dance said, "as the supply of pumpable fuels declines and electric power displaces other fossil fuel applications in homes, industry and transportation."
- Products and systems that increase productivity. Vice Chairman Dance pictured GE as working on two levels to help U.S. industry: urging Government leaders to adopt tax reform legislation and incentives that will increase the flow of capital into more productive facilities; and developing more efficient, more productive equipment for use by GE's industrial customers.
- New lifestyles for consumers. Changes such as the sharp increase in the numbers of working women, Dance said, open up worldwide opportunities for quality-built products with unique time- and work-saving features and for prompt, courteous service when needed.
- Materials engineering, resulting in materials with special characteristics not found in natural materials. The GE spectrum described by Vice Chairman Parker extends from high-temperature structural ceramics such as silicon carbide to new families of high-performance plastics.
- Natural resources, mined and marketed by General Electric's affiliate, Utah International Inc. Vice Chairman Parker portrayed Utah International as "one of the world's most active mining companies in exploration for new reserves . . . a low-cost producer well-positioned to take advantage of any upturn in demand for natural resources."
- Aerospace opportunities, led by what Vice Chairman Parker described as "the beginning of a long-delayed buying cycle" by commercial airlines that will result in an estimated $30 billion jet engine market in the next ten years — a prime opportunity for GE's family of advanced commercial engines.

Felt Forum of Madison Square Garden was the scene as over 1,000 share owners joined GE Directors and managers to review the Company's progress.

At the leading edge

Final details of this General Electric anniversary portrait were added by Chairman Jones:

"Our vision for General Electric, built on our heritage, is to be an innovative enterprise at the leading edge of technology, management and social change."

He added: "The philosopher Eric Hoffer says that man is the unfinished creature, driven to continue the work of creation. So too, this very human organization called General Electric is an unfinished enterprise, always evolving, always new, and still — after one hundred years — extending the frontiers of human progress."

Q&A: over 2,000 questions

To broaden share owner participation in the 1978 Information Meeting, the Company again enclosed question cards with the July dividend mailing. "The response has been most gratifying," Chairman Jones reported. More than 1,600 share owners mailed in over 2,000 questions or comments, while an additional 107 question cards were submitted at the meeting.

Most-often-asked questions included the following:

Business outlook for 1979: U.S. economists, Chairman Jones said, have generally lowered their growth forecasts from the 4% to 4.5% range to something like 3% to 3.5% growth in real gross national product. He added that GE economists "think that 3% to 3.5% may be somewhat optimistic" and that what happens in 1979 will depend very largely on the impact of tax cuts. General Electric goes into the year 1979 with a relatively good backlog in heavy capital goods. But in the lighter consumer products, demand will depend greatly on the results of the tax action taken by Congress and the Administration.

1979 union negotiations: The Chairman predicted that a range of items, including money and benefits, would be among areas of discussion in the negotiations aiming at a new contract with unions representing GE employees, to replace the contract that expires in June 1979. "Because of the contract that we signed in 1976 and the increases that were granted and the cost of living adjustments that were arranged, we think that we have taken pretty good care of our people, despite the inroads of inflation. We don't see the necessity for a large initial catch-up."

General Electric's progress for share owners includes an 18% increase in the quarterly dividend rate in 1978, adding up to a 62% rise over the past two years.

Dividend payout policy: Reminding share owners that the dividend was increased by some 18% this spring and that over the past two years the quarterly dividend rate has gone up some 62%, the Chairman added: "We announced in 1973 that we were going to attempt to pay roughly 50% of our earnings in dividends, because we felt that was the ratio most appropriate for growth companies such as General Electric. We have come very close to that over these last several years."

Dividend Reinvestment Plan: The reason why General Electric's plan does not permit share owners to get stock directly from the Company at a discount, as in some other plans, the Chairman said, is that "we do not view our Dividend Reinvestment Plan as a capital-raising plan. . . . Ours is simply a convenience arrangement; we can assure you that the fee that is charged to acquire the shares is much lower than you would pay through a broker for odd-lot purchases."

Why two share owner meetings? Holding a special Information Meeting in addition

to the regular annual Statutory Meeting was described by the Chairman as an innovation in share owner relations that the GE Board and management adopted 11 years ago. The Information Meeting is devoted in part to an in-depth review of the state of the business and of management's plans and in part to answering a representative cross-section of the many hundreds of questions received from share owners. The Chairman explained that the Directors have found that they get a better sense of widespread share owner concerns by attending the Information Meeting, and that while the proceedings of the annual Statutory Meeting are reported to the full Board, only a few Directors attend because the Statutory Meeting "has turned into what some newspapers have called a circus." It is not a business meeting, he said, in the sense that Directors and managers are advised of the concerns of the vast majority of share owners. "Rather, we find ourselves spending a great deal of time on very limited issues of concern to a very small number of share owners. At our last [Statutory] Meeting, which ran for some hours, nine share owners took up the entire time of the meeting, and the several hundred other share owners there were most irate by the time that meeting ended." Since it is no longer possible to have a fully democratic Statutory Meeting where everyone has a chance to participate, he added, the Company has adopted the two-meeting system, with the Information Meeting programmed around share owners' written questions rather than microphone appearances.

Outlook for major appliance sales: Most people in the industry today feel that in 1979 "the major appliance industry will be flat in comparison with this year," Vice Chairman Dance said. "It will still be a good year, but it will not be up, as this year has been." He predicted, however, that over the next five years, with demographics favoring growth, the major appliance business will increase probably 5% to 6%. "This is a big industry now. About 30 million units will be sold in the major appliance industry this year. And if it increases 5% to 6% over the next five years, that means you will have an industry of about 40 million units. So there is a real growth opportunity for your Company in this business."

In Q&A session, answers were provided by (left to right): Vice Chairman W. David Dance, Chairman Reginald H. Jones, and Vice Chairman Jack S. Parker.

Prospects for power systems: Acknowledging that "we are in a trough now . . . There are very few orders for power systems products at this point in time," Vice Chairman Dance stated that "we still think there is a real profit future in the power systems business for your Company. We're working very hard on improving productivity, getting our basic costs down, and getting our breakeven point down, so we can continue to make money in this business and increase our profitability." On the plus side, he cited an increase in overseas penetration by GE's gas turbine business, the expansion in licensing arrangements and joint ventures around the world, and the expansion of GE's installation and service engineering business. "And our meter business is growing very rapidly. With the advent of automatic meter reading and time-of-day meter reading, we think that over the next five years this business could actually double in sales and profitability." Dance also stated that "while the nuclear business is in the doldrums, we think there are real opportunities for your Company in nuclear fuel and nuclear services. And we have many opportunities in the high-voltage d-c field." As for new energy technologies, General Electric is working on solar, biomass, fusion, geothermal and wind power. "We think that there are going to be some new technologies coming before the end of the century and that your Company will participate on a profitable basis."

Status of solar energy systems: "Right

Continued low prices of General Electric's consumer goods, and the Company's productivity increases that are above the national average, contribute to the ongoing fight against inflation.

now, the economics of solar power are all in favor of using oil and gas," according to Vice Chairman Parker. "But we hope that by establishing more efficient means of collecting the heat from the sun and more efficient means of storing it, we can overcome some of the problems." He said, for example, that GE has introduced a new vacuum tube solar collector to a limited market this year and has been doing a great deal of work on solar-assisted heat pumps. "I think it is fair to say, however, that you are looking at systems that will not be popular until the middle of the next decade." And he added that it will be *several* decades before anything but a small fraction of power requirements can be satisfied from a solar source.

Wage and price controls: Asked for GE management's opinion on the probability of reimposition of wage and price controls, Chairman Jones recalled a speech by Director Walter Wriston citing research indicating that wage and price controls had been imposed at the time of Diocletian, in the days of the Roman Empire. "They hadn't worked then, and they haven't worked anywhere, ever, since. But we still seem to be caught up in the desire to attack the symptoms of inflation rather than its causes." The Chairman observed that changes in price levels for GE products have remained well below today's inflationary rates. The electrical manufacturing industry is so competitive, he said, that over the last two years, when the consumer price index went up 7.2%, "we were able to raise our prices in the consumer area only 2.7%." Responding to the question as to what the Company is doing to get ready for controls, the Chairman stated that "about all anybody can do is fight against the idea of controls and do everything possible to enhance productivity." He pointed out that although productivity on a national average is gaining at only a little over 1% annually, "I'm happy to say that the great General Electric people who work for you have managed to increase the productivity of this Company at rates that are above the national average."

Jet engine business: Commenting on the fact that when United Airlines announced its large order for Boeing 767s and Boeing 727s, "the General Electric engines were hardly mentioned, because we weren't on the airplanes," Vice Chairman Parker went on to say that "the game has just started, and we're confident we *will* be on the airplanes." He said that no excuses need to be made for the efforts of GE people in the aircraft engine business, and cited overall statistics showing that 52% of firm orders and options so far this year for engines for wide-bodied aircraft have gone to GE. "We're strong in this business, and I'm quite confident that we will continue to be strong."

South Africa progress report: Commenting on the Company's operations in South Africa, Vice Chairman Parker reported on visits earlier this year with leaders "on both sides of the equation," saying both encourage the Company to remain and continue what we are doing. A special *Update on South Africa* has just been published to provide interested share owners with information about the current status of General Electric business operations there and about the progress which has been made with and for our employees. Share owners who would like a copy should write Investor Relations, General Electric Company, Fairfield, Conn. 06431.

To conclude the meeting: a multi-image presentation recalling "100 Years of Progress for People."

General Electric at 100

Observance of General Electric's Centennial anniversary was, for 390,000 GE employees worldwide, a double opportunity:

- For GE organizational components, it provided an occasion to recognize outstanding individual performance; and
- For employees generally, it offered the opportunity for creative and resourceful ways to honor their Company's birthday.

Performance awards centered on a GE Centennial Sculpture by Steuben Glass, an interpretation in crystal that depicts General Electric as a worldwide, multifaceted enterprise. One hundred trophy-size replicas of the sculpture were prepared and apportioned to GE components as awards to be presented to deserving employees.

Nominations for these awards were made by employees in each component, with review committees recommending the final selection. Awards honored superior performance in a wide variety of forms, from creativity that opens up new business opportunities to unusually strong dedication in carrying through job responsibilities far beyond the routine.

As a focus for employees' creativity, the Centennial program was planned on the principle of encouraging individual GE components to develop their own types of observance. Employees responded with enthusiasm and exuberance. As shown here, local Centennial programs were as varied as the operations sponsoring them.

In addition, many employees marked the anniversary with individual projects, from works of art to pledges of personal involvement in community social work.

The Centennial observance was, thus, a moment for General Electric people to accept greater challenges, to review their heritage and to reconfirm their pride in belonging to a Company that is, in the words of Chairman Jones, "a future-oriented organization of men and women who aim at making the next century, like the first, one hundred years of progress for people."

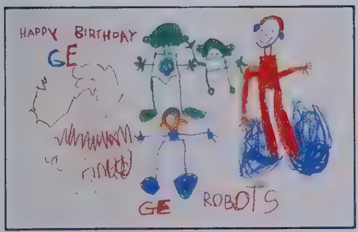
Below: To draw attention to its van telling the story of GE technology, the Research and Development Center used this 100-foot-high balloon.

Above: Hall of History at Schenectady Museum features artifacts from electrical era's beginnings.

Left: Information Services Division employees in Rockville, Md., enlivened their observance with past century's fashions.

Below: Young Brazilians wrote Edison essays in competition sponsored by GE do Brasil.

Employees make the anniversary an occasion for recognizing merit and for expressing their creativity.



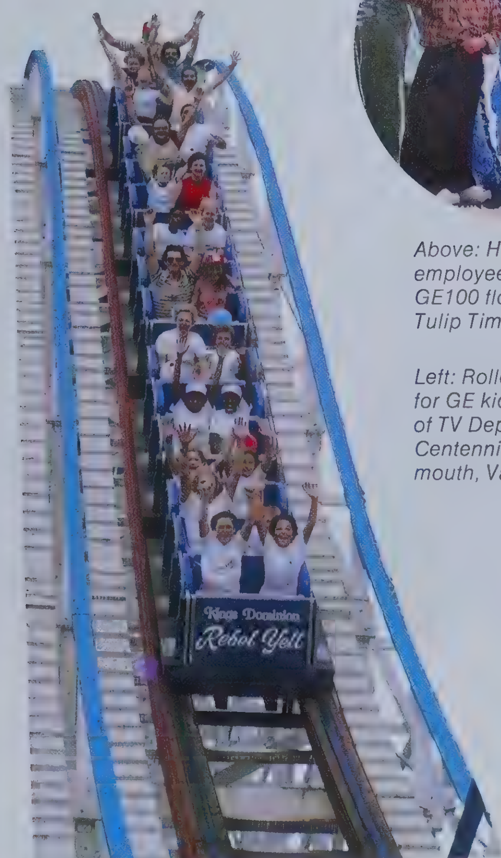
Left and below: Poster contest in Schenectady drew these young artists' views of GE future.

Left: One of 45,000 attendees at Lynn, Mass., Family and Community Day.

Below: Summer camp experience for 200 children from low-income Maryland neighborhoods was a GE 100 project.

Above: Centennial Awards of Excellence were made to GE employees demonstrating outstanding performance. R&D Center presentation included, l to r: Dr. Roland W. Schmitt, VP — Corporate Research and Development; Dr. Arthur M. Bueche, Senior VP — Corporate Technology; award winners Paul A. McConnelee and Dr. Walter H. Berninger; and Electronics R&D manager Dr. Virgil L. Stout.

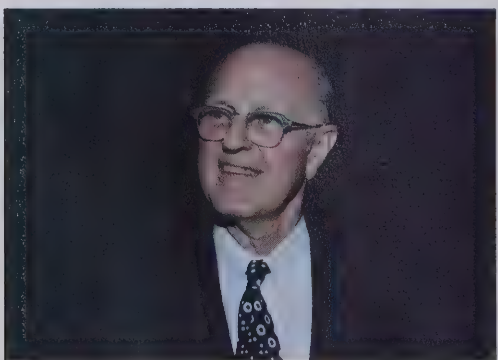
Right: Energy-education exhibits featured the Power Systems Sector's Edison Energy Fair, seen by some 150,000 people.



Above: Holland, Mich., employees entered their GE100 float in the city's Tulip Time Festival.

Left: Roller coaster rides for GE kids were part of TV Department's Centennial fun in Portsmouth, Va.

GE-sponsored symposium brings together 172 of world's technical leaders.



Opportunity to meet top technologists was provided GE people, including: top, symposium organizer Dr. Milan D. Fiske, left, with Dr. Arthur M. Bueche; middle, retired VP Dr. C. Guy Suits; bottom, Dr. Roland W. Schmitt, VP — Corporate R&D.

The observance of General Electric's 100th anniversary would have been incomplete without a deep bow to the forces of science and technology that have so largely shaped GE into the company it is today.

The event came September 19-21 in the Schenectady/Albany area. There 172 of the world's top scientists, educators, research directors, entrepreneurs and governmental advisers from all over the world accepted GE's invitation to attend the International Symposium on Science, Invention and Social Change.

Dr. Arthur M. Bueche, GE's senior vice president for corporate technology and the symposium's general chairman, stated the objectives: "to note the past, learning from it; to observe the present scene, enlarging our perspectives through the exchange of ideas; and to predict the future, seeking insights that will help shape its directions for the benefit of mankind around the world."

The past was noted in the opening address, "Edison and a Century of Innovation," by GE's director emeritus of research, Dr. C. Guy Suits.

Surveys of the present came in a series of talks on the "Contemporary Frontiers of Science," with Dr. Philip Handler, president of the U.S. National Academy of Sciences, serving as chairman. MIT Professor Victor F. Weisskopf gave an overview of physics; Professor Melvin Calvin, of the University of California, surveyed developments in chemistry; while Professor Francis H. C. Crick of the Salk Institute described the present frontiers in biology.

"The Inventor and the Entrepreneur" were the focus of the symposium's next phase, chaired by Dr. Ralph Landau, chairman of Halcon International, Inc. The speakers were inventor Jack S. Kilby; Sir Alastair Pilkington, chairman of Pilkington Brothers, Ltd., of Great Britain; and Dr. Alejandro Zaffaroni, president of the Alza Corporation.

The symposium's transition to the future was keynoted by Dr. Isaac Asimov, well-known author and science writer as well as a Boston University School of Medicine faculty member, speaking on "Probable Paths to 2078."

"Great Technical Challenges for the Next 100 Years" formed the theme of a series of addresses chaired by Dr. Courtland D. Perkins, president of the U.S. National Academy of Engineering. Speakers included Dr. William J. Darby, president of The Nutrition Foundation, Inc.; Dr. Ishrat H. Usmani, senior energy adviser for the United Nations Center for Natural Resources, Energy and Transport; and Dr. Lewis M. Branscomb, vice president and chief scientist for IBM.

A panel session on "The Role of Government in Using Technologies for Social Progress" was chaired by MIT President Dr. Jerome Wiesner. Panelists were Dr. Frank Press, science adviser to President Carter; Professor Sir Hermann Bondi, chief scientist for Great Britain's Department of Energy; Professor B. D. Nag Chaudhri, vice chancellor of India's Jawaharlal Nehru University; and Dr. Enrique Martin-del-Campo, science counselor for the Mexican Embassy in Washington, D.C.

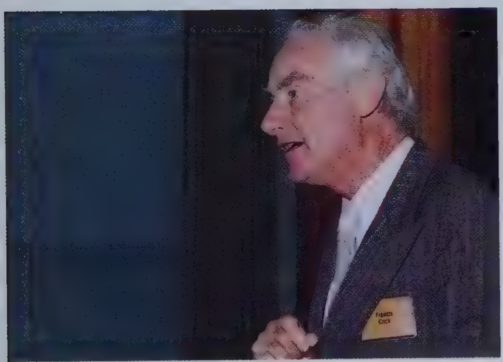
A session on "summary and predictions" was led by Albert Rosenfeld, science editor of *Saturday Review* magazine.

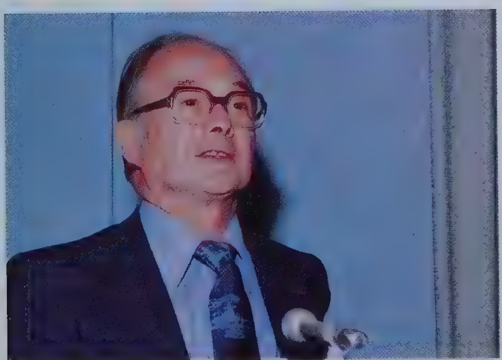
The symposium's concluding address was given by GE Board Chairman Reginald H. Jones, speaking on the "Conditions for Technological Progress." While emphasizing the need for greater Government incentives for corporate research and development spending and a more attractive risk-reward ratio for both corporate and individual investors, Jones concluded on an optimistic note:

"Any objective assessment of today's situation would have to include the positive factors:

- The grand momentum of science and technology, a human enterprise that transcends national and cultural boundaries.
- The growing awareness around the world of what it takes to achieve and sustain technological progress.
- The persistent rejection, by most people, of the counsels of despair.
- And most importantly, the irrepressible curiosity that keeps drawing mankind forward toward new knowledge, new ways of doing things — as demonstrated at this symposium."

Participants, surveying technology from Edison's day to 'paths to 2078,' seek insights that will benefit society's future.





International gallery of speakers included: top, Nobel Laureate Francis H. C. Crick; middle, Sir Alastair Pilkington; and, bottom, Dr. Frank Press, President Carter's science adviser.

Science writer Dr. Isaac Asimov's look ahead to 2078, presented at the Union College chapel, delighted symposium and general public guests.

End-results from one General Electric Centennial activity won't become evident until well into the Company's second century.

That is the Company's sponsorship of a special round of travels for Expo-Tech, the van full of motivational exhibits designed to encourage minority youth to consider careers in engineering.

If the GE-sponsored tour of Expo-Tech is successful, future years will see a continued increase in the numbers of minority engineering graduates.

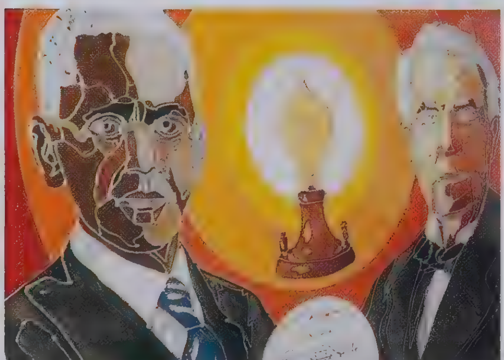
During this Centennial year, some 50,000 additional junior-high minority students are expected to visit the van and participate in its 19 "hands-on" exhibits — an experience helping them to define engineering work and to appreciate the importance of high-school mathematics and science courses as preparation for an engineering education.

Recognizing that engineering is one of the major stepping stones to high-level professional and management positions in industry, GE managers in 1972 realized that industry could not meet its affirmative action goals unless it could employ greater numbers of minority engineers. As a result, General Electric spurred a national effort in support of PIMEG — the Program to Increase Minority Engineering Graduates.

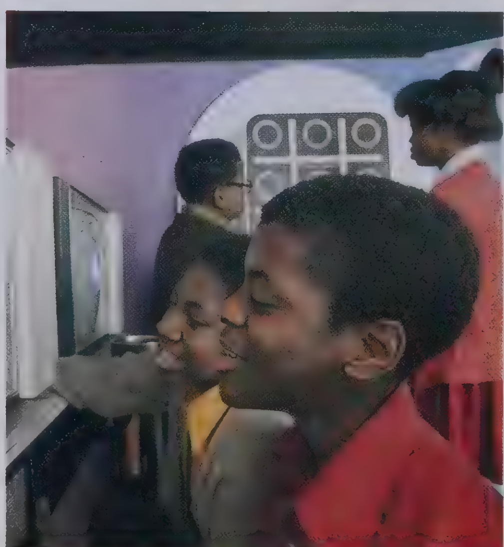
With widespread support from Government, industry and education, the program has been successful. In 1971, only 407 of United States engineering graduates were black, plus a handful from other minorities. In 1977, the number of minority engineering graduates had grown to 1582. Moreover, the number of minority students enrolled in engineering in the present school year totals nearly 20,000.

And as a result of Expo-Tech's 1978 tour, additional thousands of minority young people have reason to regard engineering as an approachable profession.

Special Centennial tour by Expo-Tech aims at encouraging minority youth to plan on engineering careers.



As a GE100 tribute, stained-glass lighted portraits of Edison and his associate, black inventor Lewis H. Latimer, have been added to Expo-Tech, along with taped narratives of their pioneering work in electricity.



Outside GE-sponsored traveling van of educational exhibits, GE's Jim Clark tells minority youngsters that if they enjoyed what they experienced in the van they should think about engineering careers.

Expo-Tech's participative exhibits include playing tick-tack-toe with a computer and drawing electronic designs on a TV screen.

Spotlighting an emerging, high growth part of tomorrow's General Electric Company. Today.

GE ENGINEERED MATERIALS

Five years ago, the Engineered Materials businesses were half the size they are today. In 1978, they represent more than a billion dollars in sales volume and are among the most attractive in the Company. And each holds either a #1 or #2 leadership position worldwide. In another 5 years, they are positioned to double in size, again. And beyond 1983, Engineered Materials offer virtually unlimited growth potential for GE. Here's an individual spotlight on each of these emerging, high growth businesses:

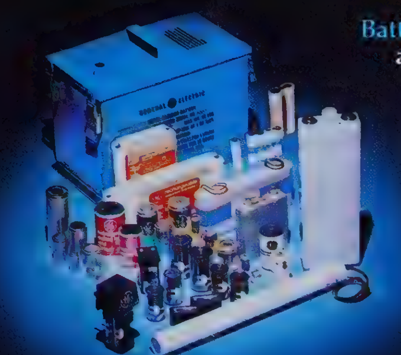
Plastics. Meeting the exploding market demand for lighter weight, consumer safety, and energy conserving products.

Metallurgical Businesses. Improving productivity worldwide with Man-made™ diamonds and tungsten carbide parts for mining and metal-working.

Laminates and Insulating Materials. A spectrum of laminates, enamels, and resins to improve product quality in electronics, motors, and electrical insulation.

Silicones. Producing sealants, resins, and high temperature rubber to extend the life of consumer, construction, and industrial applications.

Batteries. Providing portable and standby rechargeable power for broad-based, high technology industrial products and consumer needs.



Throughout 1979, we'll be reporting on new products, technologies, and opportunities that will help these businesses maintain their sales and earnings leadership.

World's fastest growing Engineered Materials Business.

GENERAL ELECTRIC

GENERAL ELECTRIC
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ACCOUNTING SERVICES
AUDITING SERVICES
ACTUARIAL SERVICES
AGRICULTURAL CHEMICALS
AGRICULTURAL EQUIPMENT
AIR CARGO
AIR CONDITIONING EQUIPMENT
AIR & GAS COMPRESSORS
AIR TRANSPORTATION SERVICES
AIRLINES
AIRCRAFT DEALERS
AMUSEMENT PARKS
APARTMENT BUILDINGS
APPLIANCES
AUTOMOBILES

BAKERIES
BANKS
BLAST FURNACES & STEEL MILLS
BLOWERS & FANS
BOAT BUILDING & REPAIRING
BOAT DEALERS
BOOK PRINTING & PUBLISHING
BOOKKEEPING & ACCOUNTING MACHINES
BOTTLERS & CANNERS
BOUTIQUES
BOWLING ALLEYS
BOX MANUFACTURERS
BRICK & CONCRETE BLOCK MANUFACTURERS
BROKERS
BRONZE, BRASS & COPPER
BUILDING CONTRACTORS
BUILDING MATERIALS
BUS COMPANIES
BUSINESS SERVICES

CAFETERIAS
CALCULATING & ACCOUNTING MACHINES
CAMPERS & TRAVEL TRAILERS
CAN MANUFACTURERS
CANDY MANUFACTURERS
CANNED SPECIALTIES
CARGO & FREIGHT TRANSPORTATION SERVICES
CARPET & RUG DEALERS
CASH REGISTERS
CEMENT MANUFACTURERS
CEREAL BREAKFAST FOOD MFG.
CHAIN OUTLET RESTAURANTS
CHAIN OUTLETS & VARIETY STORES
CHARTER SERVICES
CHEMICALS
CLAY PRODUCTS
CLINICS – MEDICAL & DENTAL
CLOTHING – RETAIL
COAL MINING

COMMUNICATION SERVICES
COMPUTERS
CONSTRUCTION EQUIPMENT MFG.
CONSTRUCTION EQUIPMENT DEALERS
CONTRACTORS
COOLING EQUIPMENT MFGS.
COPPER MILLS & FOUNDRIES

FOOD PRODUCTS MACHINERY
FOOD PRODUCT MFGS.
FOOD SERVICES
FORESTING FIRMS
FORGINGS
FOUNDRIES
FREEZER & REFRIGERATOR MFGS.

FREIGHT & CARGO TRANSPORTATION
FROZEN FOODS MFGS. & DEALERS
FURNITURE MFGS.

GARBAGE & TRASH COLLECTORS
GAS & AIR COMPRESSORS

OFFICE MACHINES
OIL WELL DRILLING CONTRACTORS

PACKAGING MACHINERY
PAPER MACHINERY
PHOTOENGRAVING

PETROLEUM REFINERS
PIPELINE CONTRACTORS
PLASTIC PRODUCTS
PLUMBING CONTRACTORS
PRINTING EQUIPMENT
PUBLISHING

QUARRIES & MINES

RADIO-TV COMMUNICATION
RECREATIONAL VEHICLES
REAL ESTATE
RAILROAD EQUIPMENT
REFRACTORIES
REFRIGERATION & HEATING EQUIPMENT
REST & NURSING HOMES
ROOFING CONTRACTORS
RUG & CARPET DEALERS

SANITARY SERVICES
SAVING & LOAN ASSOCIATIONS
SAW MILLS
SEWER CONTRACTORS
SHIPBUILDING & REPAIRING
SIDING CONTRACTORS
SOFT DRINK MANUFACTURERS
SOUND SYSTEM DEALERS
STEREO EQUIPMENT DEALERS
STEEL DISTRIBUTORS
STOREFRONT CONTRACTORS
STORE FIXTURE MFGS.
SWIMMING POOL CONTRACTORS

TELEPHONE COMPANIES
TELEVISION & RADIO RETAILERS
TEXTILE MACHINERY
TOOL MFGS.
TRANSFORMER & GENERATOR MFGS.
TRANSMISSION EQUIPMENT
TRANSPORTATION COMPANIES
TRASH & GARBAGE COLLECTORS
TRUCK DEALERS
TRUCK OWNERS & OPERATORS
TURBINE MANUFACTURERS

UTILITIES

VARIETY STORES
VAULT & SAFE MANUFACTURERS

WAREHOUSING EQUIPMENT
WOMAN'S SPECIALTY STORES

X-RAY APPARATUS

ZINC MILLS
ZIPPER MANUFACTURERS

for over 2,800 industries,
GECC is a capital idea!

Where will you find General Electric Credit Corporation capital at work? Practically everywhere you can think of.
Over the past ten years, GECC has provided some $31.7 billion in financing and leasing funds to companies in over 2,800 industrial classifications—including commercial, industrial and consumer-related businesses.
GECC has provided not only the general and special financial formats these companies needed, but a broad range of valuable related services as well.
When a company is looking for ways to expand its financial options, it can count on GECC to come up with a capital idea.

General Electric Credit CORPORATION
Administrative Offices
260 Long Ridge Rd., Stamford, CT 06902

Financial highlights

(Dollar amounts in millions; per-share amounts in dollars)

For the year	1978	1977	Percent increase (decrease)
Sales of products and services to customers	$19,654	$17,519	12%
Other income	419	390	7
Total revenues	20,073	17,909	12
Net earnings applicable to common stock	1,230	1,088	13
At year end			
Total capital invested	$ 8,692	$ 8,131	7%
Share owners' equity	6,587	5,943	11
Short- and long-term borrowings	1,954	2,056	(5)
Measurements			
Net earnings per common share	$ 5.39	$ 4.79	13%
Dividends declared per common share	2.50	2.10	19
Operating margin as a percentage of sales	10.0%	9.7%	
Earnings as a percentage of sales	6.3	6.2	
Percent earned on average total capital invested	16.3	15.8	
Percent earned on average share owners' equity	19.6	19.4	
Borrowings as a percentage of total capital invested	22.5	25.3	

	Revenues			Net earnings		
Operating results by industry segment	1978	1977	Percent increase	1978	1977	Percent increase (decrease)
Consumer products and services	$ 4,788	$ 4,148	15%	$ 300	$ 256	17%
Net earnings of General Electric Credit Corporation	77	67	15	77	67	15
	4,865	4,215	15	377	323	17
Industrial products and components	4,124	3,698	12	223	191	17
Power systems	3,486	3,218	8	102	75	36
Technical systems and materials	4,745	4,145	14	278	248	12
Natural resources	1,032	965	7	180	196	(8)
Foreign multi-industry operations	2,767	2,562	8	78	71	10
General corporate items and eliminations	(946)	(894)		(8)	(16)	
Total Company	$20,073	$17,909	12	$1,230	$1,088	13

The results by industry segments here and throughout this Report reflect the Company's Sector organization. Additional information about industry segments is presented on pages 43 and 44.

	Revenues			Net earnings		
Operating results by geographic segment	1978	1977	Percent increase	1978	1977	Percent increase
United States	$16,443	$14,560	13%	$ 961	$ 846	14%
Far East including Australia	1,109	1,056	5	170	162	5
Other areas of the world	3,270	2,917	12	103	83	24
Elimination of intracompany transactions	(749)	(624)		(4)	(3)	
Total Company	$20,073	$17,909	12	$1,230	$1,088	13

Additional information about geographic segments is presented on page 44.

As used in this Report, "revenues" consists of sales of products and services to customers and other income from external sources.

The Chairman comments

General Electric Corporate Executive Office, providing overall managerial direction for General Electric's span of businesses: Chairman Reginald H. Jones, center, with Vice Chairmen Walter D. Dance, left, and Jack S. Parker, right.

General Electric's Centennial year was one in which your Company's sales and earnings reached new highs. Sales rose by 12% to $19.7 billion, while earnings of $1.2 billion, or $5.39 per share, were up 13%.

Several significant aspects of your Company's performance deserve to be singled out:

• Confident of the Company's results and prospects, your Board of Directors increased the quarterly dividend for the third year in a row. The increase to 65 cents a share with the July 1978 payment represented an 18% increase, and together with the earlier increases amounts to more than a 62% climb in dividends since July 1976. These increases are in line with our objective of paying about 50% of current earnings in dividends, retaining the rest to grow the business in the share owners' interest.

• General Electric's earnings are outperforming growth in the U.S. Gross National Product – an achievement that reflects management's long-term objective to outpace the growth of the economy. Through strategic planning and differentiated resource allocation, we have diversified our sources of earnings into a variety of expanding markets, international as well as domestic.

• General Electric has outgrown its traditional role as an equipment manufacturer whose fortunes are governed by the U.S. electrical load growth curve – the rise in the demands for electricity. The Sector reviews that follow in this Annual Report show that our businesses are responding to a broad range of forces and trends as they tap new sources of growth, including new types of products, a wide array of man-made materials and natural resources, and varied services businesses.

The outlook: The U.S. economy appears to be making a strong start in 1979 – thanks to the tax cut, good housing starts in late '78, and industry's high backlogs of orders for capital goods. Our GE economists do expect a slowdown in the second half as tight money and high consumer debt will probably dampen consumer and housing expenditures.

However, business investment – stimulated by tax reductions from the Revenue Act of 1978 – should help to offset the slower growth of consumer markets. In addition, faster expansion in industrialized countries and some recovery in the developing nations should strengthen export markets and trim back this country's serious trade deficit.

The most serious long-term U.S. economic problem continues to be inflation. Its cure will depend primarily on strong Government fiscal and monetary policies, and regulatory restraint. If the Government's anti-inflationary efforts succeed in moderating the rate of inflation later in 1979, then our economists believe we should see a quarter-by-quarter improvement in 1980, leading to continued solid expansion based mainly on strong capital outlays, revived consumer spending, and a growing world economy.

For General Electric, the major area of uncertainty is near-term consumer spending – but plans have been developed, and are being implemented, to maintain good profit margins despite a possible slowing in consumer demand.

We face the future with ample financial strengths, including a solid cash position backed by a favorable 22.5% debt-to-capital ratio and a triple-A credit rating.

Thus we feel that General Electric is well positioned to ride through any slowing in the economy's growth rate and to enter an upturn with strong, well-directed momentum.

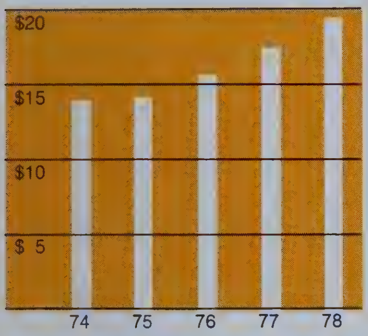
We continue to invest strongly in the future. As discussed more fully on page 22, we maintained our vigorous commitment to research and development in 1978 with expenditures totaling $1,270 million for Company-funded projects and R&D work performed under contract. Also, we made record plant and equipment investments of $1,055 million.

Most importantly, we have seasoned management, in depth – men and women who know how to make the most of the Company's considerable assets.

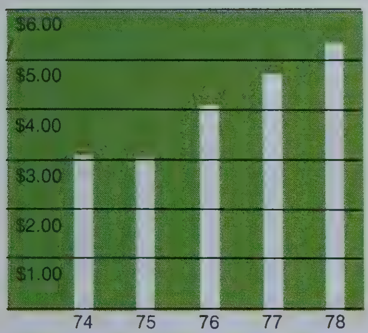
Your managers are optimistic with regard to the successful negotiation of new contracts with labor unions to replace those that expire in June 1979. While inflation is a continuing problem, the wage increases granted under the 1976-79 contract, including cost-of-living adjustments, have enabled GE employees' earnings to keep ahead of inflation, so that we do not anticipate the necessity for a substantial "catch-up" adjustment.

GE's Centennial year was one of new highs:

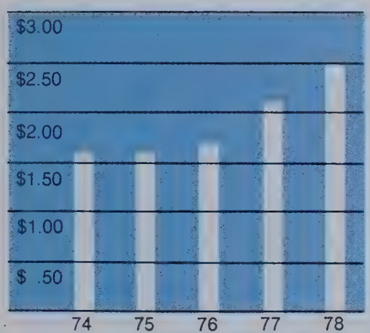
Sales (billions)



Earnings per share



Dividends declared per share



Corporate governance: Your managers consider it one of our basic responsibilities to make our views known on public issues affecting business and to strive for changes that will improve the economic, political and social environment in which business operates.

One issue that has been coming into increasing prominence directly concerns the relationships among share owners, their boards of directors and business managers. The shorthand term for this issue is "corporate governance." For "governance," one might well substitute "responsibility" or "accountability," since the focal point for this issue is whether sufficiently strong control mechanisms are in place to make sure that managers perform responsibly in the best interests of share owners, customers, employees and the other constituencies of business.

Business critics, citing a few well-publicized lapses and failures in business performance, argue that present controls over corporate authority and power are inadequate, even though the cited cases are exceptions to the standards maintained by the overwhelming majority of enterprises. While some opponents try to make corporate governance a catchall for their varied grievances against business, the most substantive issue at present centers on the role and composition of corporate boards of directors. The critics claim that corporate boards, as presently constituted and organized, provide only a "rubber stamp" function, automatically giving managers the approvals they need. Proposals for change cover a wide spectrum, from severe limitations on who can qualify as directors to the idea of more stringent Federal, as distinct from state, chartering.

This criticism does not seem to apply to General Electric. From the Company's beginnings, GE share owners have been represented by a Board made up predominantly of Directors from outside the Company. Your managers through the years can verify that the GE Board has been vigorous and highly independent in its vigilance on behalf of the interests of share owners and the public generally.

Nevertheless, your Board has accepted corporate governance as a valid issue. Your Directors' early sensitivity has led to a structure of the General Electric Board that meets the objectives both of enlarging its role and of facilitating its work.

The front cover of this Annual Report depicts the Board's organization into seven Committees, with each assigned to concentrate on monitoring a major aspect of the business. Reports by the Chairmen of these Committees, included on pages 23-25, show that today's Committee structure, which began to evolve in 1972, has been effective in enabling your Directors to be more penetrating in their involvement in the business, as well as more informed and challenging in their appraisals of management's performance.

The governance of General Electric is, we believe, illustrative of what responsible business enterprises are doing to maintain tight controls and disciplines. In business, as in any large organization from governments to churches, there obviously can be no absolute safeguards against unethical or antisocial acts by individuals. But evolutionary business-initiated measures such as the more effective structuring of boards of directors will help guard against substantial corporate misconduct or serious legal, social or ethical lapses.

The great danger, as we see it, is that business critics will succeed in their efforts to swell the ripple of concern represented by corporate governance into still another wave of Government regulation and restriction. U.S. industry's efforts to provide good values for its customers, and to compete against international producers, are already hampered by the effects of excessive regulation in reducing managerial flexibility and increasing costs. Rather than add new regulatory burdens, the wiser response to the issue of corporate governance is, in our view, to continue strengthening the systems of checks and balances and the lines of accountability that are already in place.

We ask the share owners of General Electric to enlarge their own understanding of corporate governance, believing that the great majority of those who do so will support the efforts of corporate managers both to make the system work better and to withstand the impractical and counterproductive measures that some critics propose.

Reginald H. Jones

Chairman of the Board
and Chief Executive Officer
February 16, 1979

Consumer Products and Services

(In millions)	1978	1977	1976	1975	1974
Revenues*	$4,865	$4,215	$3,510	$3,059	$3,413
Net earnings*	377	323	261	164	128
*Includes net earnings of General Electric Credit Corporation	77	67	57	50	37

John F. Welch, Jr.
Senior Vice President and Sector Executive

Consumer Products and Services Sector enjoyed a good year in 1978, with revenues up 15% and earnings rising 17%. These amounts include General Electric Credit Corporation's net earnings which showed a strong 15% gain. Some 23% of total GE revenues and 30% of earnings were contributed by the Sector, including a GECC contribution of 6% to earnings. Lighting products had a particularly good year. Major appliance sales were up, but margin rates were slightly lower due to the cost-price squeeze. We are improving productivity and reducing costs in our appliance operations to maintain profitability despite possible slower market growth in 1979. For the longer term, our major thrusts are product innovation, increased emphasis on services and continuing improvement in productivity.

Representative consumer products shown above: energy-saving major appliances; housewares; lighting products, such as new halogen headlamps; audio products; and air conditioning equipment, exemplified by Weathertron heat pumps undergoing climatic test. Others: television receivers; broadcasting and cablevision services; appliance service; and General Electric Credit Corporation.

Lighting products sales and earnings in 1978 were well ahead of 1977, continuing the strong growth of recent years. This record has been accomplished primarily by innovations, particularly developments in high-efficiency lighting that conserve energy and reduce energy costs.

Energy-efficient lighting systems such as our Lucalox® lamps are being used for replacement of lower-efficiency systems in the lighting of streets, stadiums and industrial and municipal buildings. Typical is the use of 1,000-watt Lucalox lamps at Northern Arizona University's recreation and meeting facility. Lamp evaluation showed that these GE lamps could reduce energy costs and cut installation and maintenance charges while increasing lighting levels ten percent.

Among the new fluorescent lighting products we introduced in the commercial market in 1978 was the 40-watt Maxi-Miser® indoor fluorescent lamp/ballast system. Compared with standard fluorescent systems, it uses 14-to-19% less wattage, gives 20-to-24% more light output per watt and lowers operating costs. Among our new offerings for the consumer market was a Soft White fluorescent lamp for home use.

Lamp technology is opening growth opportunities in other areas. A halogen sealed-beam automobile headlamp, designed to meet the new U.S. Department of Transportation (DOT) standard, was introduced in 1978. The DOT standard allows doubling of the present high-beam candlepower of two- and four-lamp automobile systems to a maximum of 150,000 candlepower. The new GE lamps will provide a brighter, whiter light on high beam, an added safety margin for motorists.

Also, the Company's new developments in FlipFlash® II and FlashBar II photo lamp arrays, which provide more uniform light distribution for better pictures, are enabling GE to benefit from rapid growth in demand for instant cameras.

Major appliances, including GE® and Hotpoint® brands of kitchen and laundry equipment, had higher sales than in the previous year. Earnings were also up, although margin rates were slightly lower as a result of the cost-price squeeze. We initiated measures during the year to position the business to maintain its profitability despite a possible slowing in major appliance markets.

The high rate of housing completions in 1978 provided good opportunities for our contract market operations, which sell to builders and contractors.

Innovations introduced in 1978 helped to open up market opportunities and give consumers good reasons for upgrading old appliances with new GE or Hotpoint models.

A new Spacemaker® microwave oven, which can be wall-mounted or hung from cabinets, combines versatility and simplicity of operation, and builds General Electric's stake in the rapidly expanding market for microwave cooking equipment.

We offered consumers innovations that enable our appliances to use less energy. Our new high-performance Potscrubber® III dishwasher, adding ten patentable inventions deriving from more than six years of intensive technological and design effort, lowers water consumption by nearly 40% and thus reduces the energy required in water heating. Similarly, new low-energy-use refrigerators were introduced by GE in 1978.

We are also innovating in the area of after-sale service. Responding to the needs of the increasing number of households in which all adult members work outside the home, the Company in 1978 further expanded its weekend and evening appliance service in a number of locations. General Electric maintains a total of 129 factory service operations for General Electric and Hotpoint major appliances, room air conditioners and GE television receivers. This GE-operated service network, reaching from Maine to Hawaii, is available to approximately 72% of the users of these GE products and is supplemented by thousands of independent service organizations trained and franchised by General Electric.

Air conditioning sales increased substantially in 1978, benefiting from increased housing completions and continued strength in the retail market. The sharp earnings improvement reflected effective cost controls and favorable volume, both in room air conditioners and in the Weathertron® heat pump segment of the central air conditioning business.

Strong demand for central air conditioning in new homes has been a major factor in the growing penetration of heat pumps in single-family and multi-family home markets. In 1978, heat pumps were installed in about 20% of new single-family homes. Weathertron is the number one brand in this growth market.

Housewares and audio products had good earnings leverage on higher 1978 sales. In a business whose success depends on new products and new features, we marketed a wide range of innovative new products and models in 1978. Our

Innovations in GE lighting products include Soft White fluorescents for residential use, FlipFlash II and FlashBar II for photography, and a new deluxe version of the Bright Stik® self-ballasted fluorescent lamp called the Hi-Light®.

The Spacemaker microwave oven offers an innovative alternative to countertop microwave cooking. Installed over an electric cooktop or range, it is convenient, but up and off the counter, with a built-in vent and cooktop light.

Among the wide range of new housewares and audio models marketed in 1978 were: a digital scale that computes weight electronically; a restyled Toast-R-Oven® toaster that broils, bakes and toasts; a nine-volt battery-powered Home Sentry® smoke alarm; the Curl Tamer hair straightener/relaxer; and the His 'n Hers® FM/AM electronic digital clock radio.

GE Widescreen 1000 Home Television Theater, introduced in 1978, has a 1,003-square-inch picture but a depth no greater than that of a traditional 25-inch color console.

new developments enabled us to enter new segments of the industry with the Curl Tamer® hair straightener and relaxer and the cordless electronic digital scale. A new food processor which includes a blender increased General Electric's already significant position in the food processor market. And a new electronic digital FM/AM clock radio reinforced the Company's leadership in the radio market.

General Electric's housewares business offers consumers small appliances for food preparation, garment and personal care, and home safety and security. The Company's audio products include portable and clock radios, tape recorders and players, and CB mobile and base station transceivers.

Television receiver operations showed strong gains in sales and earnings in 1978. The highlight of the year's new product introductions was the Widescreen 1000 Home Television Theater, a flat-screened color TV set with a picture three times the size of that on today's standard 25-inch color television receiver. These units also feature GE's Emmy-award-winning vertical interval reference (VIR) broadcast-controlled color signal system.

In late November, the Company was advised by the United States Department of Justice that it would challenge, if consummated, the previously announced proposal to form a new television receiver company owned jointly by General Electric and Hitachi Ltd. of Japan. Alternative relationships with Hitachi are under review.

Broadcasting and cablevision operations of General Electric currently include 3 VHF television stations, 3 AM radio stations and 5 FM radio stations, plus 13 cablevision systems. Increased earnings of these businesses in 1978 reflected the favorable impact of higher advertising revenues.

In February 1979, General Electric and the Cox Broadcasting Corporation executed a definitive agreement for combining Cox Broadcasting (whose principal businesses are radio and television broadcasting and cable television) with General Electric's broadcasting and cable-television broadcasting operations. Completion of the transaction is subject to receipt of corporate and Governmental approvals.

General Electric Credit Corporation earnings were $77 million in 1978. Higher earned income on receivables was partially offset by higher interest expense.

This wholly-owned, nonconsolidated finance affiliate has steadily diversified beyond its original base in the financing of General Electric consumer products to the point where it has extensive interests in commercial and industrial financing as well as in consumer markets in the U.S. Today, products of companies other than General Electric constitute the major portion of products financed by GECC. See note 12 to the financial statements for additional information and condensed financial statements. A separate annual report giving further information on General Electric Credit Corporation is available on request.

The outlook for the consumer durables and services industry is mixed for 1979, but favorable over the next five years as large numbers of young adults from the post-World-War-II generation enter the age of maximum consumer purchases, and as new lifestyles create markets for unique products.

Lighting products markets are expected to display continued strength during 1979, spearheaded by higher demand for photo lamps, increased use of energy-efficient lighting, and the mass marketing of halogen headlamps for automobiles.

Our major appliance operations are continuing their programs to improve productivity and reduce costs in order to maintain profitability despite the anticipated slow growth in industry sales during 1979. We are not, however, cutting back on our programs for innovation. Through new advances in products, with increased emphasis on the application of electronics technology, we expect that many consumers will want to replace their appliances earlier.

Advances based on electronics technology are also expected to renew growth for housewares and audio products beyond the economic slowing generally predicted for 1979.

Services businesses such as broadcasting and credit financing offer growth potentials for General Electric. We are continuing to develop our interests in broadcasting. The proposed combination with Cox Broadcasting Corporation offers the opportunity for General Electric to extend and upgrade its broadcasting operations.

As an innovative leader in credit markets, General Electric Credit Corporation has broadened its scope so that its earnings are better able to withstand the pressures of slower consumer markets and higher interest rates expected in 1979.

Industrial Products and Components

(In millions)	1978	1977	1976	1975	1974
Revenues	$4,124	$3,698	$3,270	$3,027	$3,284
Net earnings	223	191	160	133	148

Stanley C. Gault
Senior Vice President and Sector Executive

Industrial Products and Components accounted for 20% of total GE revenues and 18% of earnings in 1978, reflecting good improvement in all major business elements. Areas of emphasis for our operations included the penetration of new markets, energy-conserving innovations, high-quality product performance and reliability, and further development of service capabilities. As a result of these positive factors, revenues rose 12% above the 1977 level, and earnings were up 17%.

(continued on pages 10-11)

Industrial products and services shown above: transportation systems, represented by "New Series" locomotives; capital equipment, such as steel mill systems; component products that include new fuel-saving controls for automotive air conditioners; and an apparatus service shop network. Others: electronic components; construction and automation equipment; and a network of supply houses.

GE industrial equipment businesses, supplying electrical products for construction applications in addition to capital equipment such as motors, drives and controls, improved sales and earnings as a result of several positive economic forces in 1978.

One force was the past year's high rates for housing starts and increased volume in commercial and industrial construction. General Electric's contractor equipment businesses, providing such products as electrical distribution and circuit protective equipment, general purpose controls and wiring devices, capitalized on the year's market growth to achieve excellent results.

We expect these businesses to sustain their strong performance, while we continue to seek new market opportunities through product innovation. Among the General Electric developments announced in 1978 was a low-voltage programmable lighting control system that applies computer techniques to control the scheduling of lighting in commercial and industrial buildings.

Many of our products help our industrial customers increase productivity. An important 1978 development was the introduction of the Company's new line of limit switches whose six-way sealing system overcomes the major cause of premature failure by preventing infiltration of environmental contaminants. These switches offer new reliability in the most rugged industrial environments of the metalworking, automotive and material-handling industries.

Metalworking operations seeking to increase productivity have given rapid acceptance to General Electric advances in computerized numerical control equipment. These control devices automatically guide machine tools through complex sequences of operations by using computer-stored instructions to provide added flexibility.

As a leader in systems utilizing large electric drive motors and controls to enhance steel mill productivity, General Electric is helping many nations throughout the world fulfill their objective of installing their own steel-making capacity. Participation in international markets has sustained good levels of General Electric orders for this equipment in recent years.

The worldwide need to increase the use of coal as an energy source has brought expanding market opportunities for motors and controls that power draglines, shovels and other mining equipment. General Electric sales of this equipment in 1978 were at record levels.

Component products, such as appliance and electronic components supplied for use in GE products and those of other manufacturers, had significantly higher 1978 earnings on sales increases that reflected the year's high levels of spending for consumer durables.

GE in 1978 held its position as the leading supplier of small electric motors, controls and other components to the air conditioning and appliance industries. Growth for these products has been strengthened by the upsurge in sales of heat pumps for all-electric heating and cooling. High-efficiency specialty motors developed by General Electric component operations have been applied by a number of heat pump manufacturers – including GE in the production of its Weathertron® heat pump.

A breakthrough was made in the automotive field in 1978 by applying GE components to automobile air conditioners. Our specially-designed cold control, part of a new system to disengage the compressor when air cooling is not required, saves up to one mile per gallon in gasoline consumption. The General Electric controls are already standard equipment on some 1979 autos, and the Company is actively pursuing other energy-saving applications. Varied General Electric components for prototype electric cars represent an area of longer-range potential.

During 1978, our business in specialty transformers benefited from two uptrends. Improved construction markets brought increased sales of these transformers for power distribution in industrial and commercial buildings. Similarly, we shared in the year's sales rise by heavy-machinery manufacturers that use transformers as components in their equipment.

Strengthening of the U.S. economy in 1978 also aided the sales of electronic components, including signal and power semiconductors, and electronic devices such as receiving and microwave tubes. Our power capacitor business has made a successful transition to a new dielectric fluid that is highly efficient as well as environmentally acceptable.

Also included among the Industrial Products and Components Sector's operations is General Electric's food service equipment business, supplying commercial kitchen appliances. With Americans spending more than one-third of their food dollars on meals away from home, this General Electric operation has developed a growing business in heavy-duty electric cooking and warming products. GE equipment is in use in many fast-food restaurant chains as well as in installations that range

With eating-out enjoying increasing popularity, GE is participating with a line of microprocessor-controlled commercial food service equipment.

General Electric serves industry's drive to increase productivity. Shown: new Mark Century® 1050T numerical control that applies advanced microprocessor technology to increase the efficiency of machine-tool operations.

from the U.S. Senate cafeteria to offshore oil-drilling rigs.

Transportation equipment supplied by General Electric includes diesel-electric and electric locomotives, transit cars, and motorized wheels for large off-highway vehicles.

The year's strong increases in earnings on somewhat higher sales were led by locomotives. General Electric units sold well both in the U.S. and in international markets.

Domestically, the Company's "New Series" locomotive, whose introduction in 1976 was timed to benefit from the upturn in capital expenditures by U.S. railroads seeking to maintain their rolling stock and prepare for increased coal shipments, had its best year in 1978. This "New Series" design provides a significant advance over previous models by lowering railroad operating costs through superior performance, reliability and fuel efficiency.

During 1978, deliveries began on 20 diesel-electric locomotives for the Philippines, and delivery was completed on 26 units for Kenya. Orders were received during the year for 83 locomotives for Mexico to be produced during 1979 and 1980.

Our transit car operations in 1978 completed production on the 230-car contract for the State of New Jersey/Erie Lackawanna line. With the two-year industry drought in new vehicle orders continuing, we have sought overhaul and rebuilding contracts, and began the overhaul of 34 Metroliner cars for Amtrak in 1978.

A profitable offshoot of this business has been the application of General Electric's highly reliable traction motors to power oil-drilling rigs. We have participated effectively in the growth of this industry.

The Company's business in motors to be mounted in the wheels of off-highway haulage vehicles was slowed in 1978 by slackness in the copper mining industry, a principal user of this equipment. However, anticipating increased future demands for surface mining apparatus, we are investing to support our leadership position in this technology.

Services businesses conducted by this Sector include:

- Apparatus service shops, applying GE expertise to the maintenance, inspection, repair and rebuilding of a wide spectrum of industrial equipment produced by other manufacturers as well as General Electric. In 1978, earnings from the GE worldwide network of these shops continued to show excellent growth, even with higher programmed expenses for capacity expansion both geographically – through adding shops to serve additional market areas – and by diversifying into new, higher-technology types of services. During the year, four new shops were added in the U.S. and five in international locations. Representative of business development are new capabilities for instrument repair and rental, communication equipment leasing, and repair of large, complex pumps and compressors.
- Distribution services, provided by the General Electric Supply Company. Offering supply centers stocked with a broad line of GE and other products needed by contractor, industrial, commercial and utility customers, General Electric Supply Company benefited from the year's increased construction activity to achieve another year of improved results.

The outlook for the varied markets served by the Industrial Products and Components Sector is generally favorable:

- Plant and equipment expenditures by U.S. industry are expected to increase considerably faster than the economy as a whole in 1979, providing continued good markets for our industrial equipment. Offshore markets for these products also remain active.
- Commercial and industrial construction is scheduled to rise significantly in 1979, bringing further market opportunities for the Company's contractor equipment and for General Electric Supply Company operations.
- With increased domestic rail traffic resulting in new locomotive orders, General Electric's locomotive operations entered 1979 with a large backlog. Also, increased interest in export orders indicates renewed strength in international markets for these products. Growth is resuming in the market for large off-highway mining trucks which use electrical propulsion systems similar to those used in locomotives.
- While forecasts for consumer durables generally anticipate slower markets in 1979, General Electric's component products operations are striving to offset the effects by further penetrating automotive and other markets.
- Worldwide growth in industrial maintenance and repair markets served by our network of service shops is expected to continue well into the 1980s.

In all of these businesses, we are making timely investments in human and physical resources which will provide our customers with high-performance products as well as effective after-sale services.

U.S. emphasis on increasing coal production is bringing an upturn in orders for General Electric motors and controls that power huge dragline equipment.

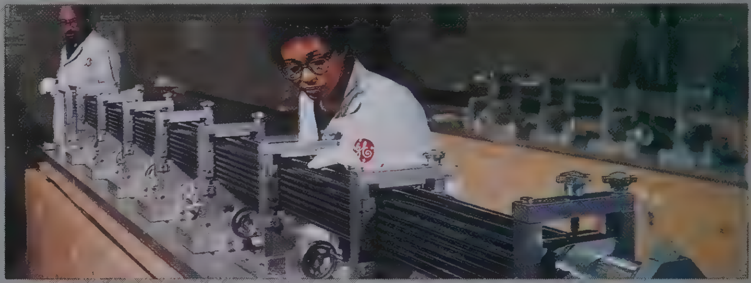
GE developments to aid environmental protection include new dielectric fluid for electrical capacitors, called Dielektrol® I, that is responsive to today's environmental standards.

Power Systems

(In millions)	1978	1977	1976	1975	1974
Revenues	$3,486	$3,218	$2,998	$2,885	$2,762
Net earnings	102	75	61	62	94

Thomas A. Vanderslice
Senior Vice President and Sector Executive

Power Systems businesses, which contributed 17% of total GE revenues and 8% of net earnings in 1978, had good operating results. New orders for our heavy apparatus were hampered by uncertainties in U.S. electrical load growth and national energy policies. However, we have a number of factors working in our favor, including international strength in gas turbines, substantial nuclear power plant fuel commitments, new growth in meters, and an upswing in our equipment maintenance services. By taking advantage of opportunities in these markets and by their diligent efforts to control costs and reduce breakeven points, our managers in 1978 achieved a 36% gain in earnings on an 8% increase in revenues.



Power Systems serve industrial, marine and electric utility markets with products and services such as those illustrated above: power generation equipment; nuclear fuel and services; high-voltage d-c transmission research and development; and installation and service engineering. Others: gas turbines, nuclear reactors and power delivery equipment.

Power Systems achieved good operating results, including a sharp increase in earnings in 1978. Slow growth in electrical demand currently leaves many U.S. utilities with ample reserve margins in generating capacity. Industry orders for nuclear power systems remained low, in part because utilities are awaiting clarification of Government policies on licensing procedures and disposition of nuclear waste. These factors are reflected in the decline in the Sector's backlog of unfilled orders. Including nuclear equipment, the backlog was $11.9 billion at the end of 1978, compared with $13.2 billion at the previous year end.

Steam turbine-generator earnings were up sharply from 1977 on somewhat higher sales.

Sales and earnings of large steam turbine-generators were well ahead of the prior year, and sales and earnings of smaller size steam turbine-generators were below the 1977 levels.

The orders backlog for steam turbine-generators was $4.1 billion at year-end 1978, of which $1.9 billion is scheduled for shipment after 1983. The comparable backlog for 1977 was $4.8 billion, of which $2.2 billion was scheduled for shipment after 1982. The decrease from the 1977 year-end backlog was attributable to 1978 shipments that exceeded new orders and to elimination of orders no longer expected to go into production.

Earnings of mechanical drive turbines were again strong on somewhat higher sales. General Electric remained a leading supplier of these units for utility and industrial applications, including petrochemical plants and those used in the production of liquefied natural gas.

An excess of shipping capacity among maritime customers continued in 1978, reducing orders for commercial marine equipment. Resources of this business were applied to ongoing projects for the United States Navy.

Gas turbine earnings continued strong in 1978, as international demand offset low domestic sales. General Electric maintained its leadership as a worldwide supplier of gas turbines for electric peaking, mid-range and industrial applications, including pipeline pumping and process drives.

During 1978, the Sector shipped its first new MS6001 heavy-duty gas turbine for electric power generation. This advanced unit is designed to produce 40% more output and 10% higher thermal efficiency than the MS5001, and is expected to provide customers with excellent reliability, maintainability and fuel flexibility.

Also during the year, General Electric began work for the U.S. Department of Energy for the second phase of a three-phase program to develop an environmentally compatible, highly efficient, water-cooled gas turbine designed to burn coal-derived fuels. This project is among the largest ever funded by the U.S. Government in the area of fossil power generation, and involves the design, construction and testing of key components needed for a commercial unit rated at 72,500 kilowatts.

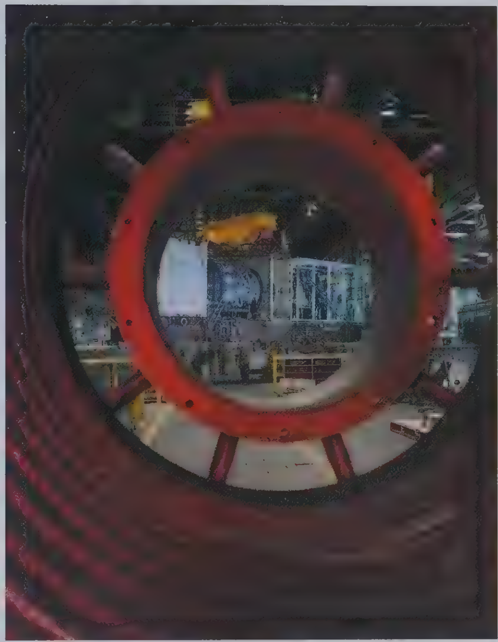
Nuclear systems include boiling water reactors (BWRs) and fuel assemblies. This business continued to operate at a loss in 1978, as the Company made further substantial expenditures on engineering and development in support of nuclear projects in the backlog. These expenditures, in addition to the effects of deferments of shipments and cancellations of nuclear orders, are expected to result in continuing losses for this business.

For General Electric's nuclear power operations, 1978 was a record year in terms of plant start-ups. In total, nine BWR nuclear plant projects supplied by General Electric and its international licensees reached start-up in five countries during the year. The Company's backlog of nuclear equipment orders at year-end 1978 was $5.1 billion, of which $2.4 billion is scheduled for shipment after 1983. The comparable backlog for 1977 was $5.5 billion, of which $2.3 billion was scheduled for shipment after 1982.

There are opportunities for profitable growth in the nuclear fuel and service markets. During 1978, we received several significant commitments for nuclear power plant fuel. A closely integrated program linking our nuclear business and the Sector's installation and service engineering operations has been developed to enable General Electric to pursue the full range of opportunities from installation to maintenance of nuclear power facilities.

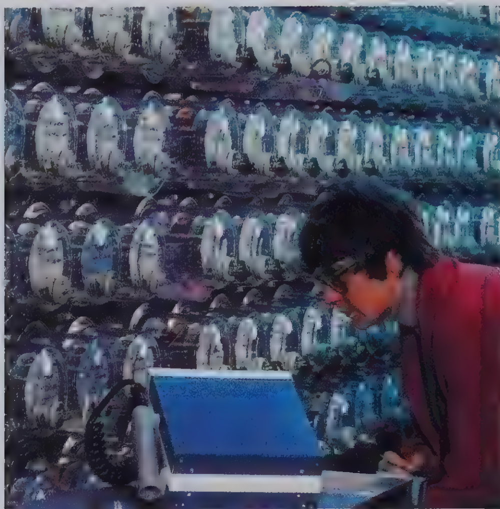
General Electric's power delivery businesses, producing transformers, power circuit breakers, switchgear and meters, reported sales and earnings well ahead of 1977, and the market for these products showed a slight improvement during the year. Company programs for controlling costs, improving efficiency, consolidating operations and upgrading equipment contributed to improved margins.

A new time-of-day IR-70 watthour meter was made available to utilities during the



Electric utilities worldwide, needing additional power generation in a hurry, have a new highly reliable option from GE. It's the MS6001 gas turbine, a factory-packaged power plant that can be installed far more quickly than other forms of power generation.

Professionals in the technology of GE steam and gas turbine (STAG) combined-cycle plants, Deborah Comstock (left), Manager of STAG Electrical Design, and Jeanne Place, Manager of Compressor Aerodynamics, discuss the plants' arrangement flexibility in meeting varied customer site requirements.



Electrical consumers' interest in lower-priced electricity at off-peak, low-demand time periods has created a growing market for GE IR-70 programmable time-of-day meters, shown on test at the Somersworth, N.H., plant.

At General Electric's Pittsfield, Mass., facility, a laboratory technician uses this kingsize gas-filled capacitor to check the quality of high-voltage transmission equipment.

year. The meter is designed to be compatible with rate structures that change according to the time of day in order to encourage customers to spread their electrical demands more evenly over the daily cycle. A new GE Automatic Meter Reading and Control (AMRAC®) load management system was used in field trials at seven utilities during the year, providing remote time-of-day readings and increased utility influence over demand cycles.

A major new high-voltage direct-current (HVDC) transmission facility was opened at Lenox, Mass., during the year to facilitate research into more efficient overhead power transmission systems.

Installation and service engineering businesses, providing on-site engineering services to electric utility, industrial and marine customers, had higher sales and earnings in 1978. Despite the continued low level of domestic installation projects, these service businesses continue to grow by successfully pursuing maintenance opportunities, diversifying into new engineering services on old equipment, and meeting the international demand for both equipment installation and maintenance.

The outlook for Power Systems businesses over the short term is favorable. Current schedules of increased shipments, the continued strength projected in demand for gas turbines, and a further modest recovery expected in power delivery markets underlie this favorable outlook.

Our intermediate-term forecasts, however, are somewhat less optimistic. As the result of the current low level of new domestic orders for power generation and power delivery equipment, our current shipping schedules call for an eventual reduction in the level of business. Operating managers of the Power Systems Sector are taking two main types of actions aimed at sustaining earnings in the face of these adverse pressures:

- They are maintaining their efforts to reduce overhead, lower costs and improve productivity, and thus achieve still lower breakeven points, so that these businesses will remain profitable at reduced production levels.
- They are vigorously pursuing the available growth opportunities. These include overseas markets for power apparatus that are growing faster than those in the United States. A number of fuel-short countries are showing increased interest in combined-cycle plants that integrate steam and gas turbines to realize high efficiencies in fuel use. High-voltage direct-current transmission is another advanced technology that seems on the threshold of growth. Still other opportunities include new meters for load management systems, and the sophisticated plant maintenance capability offered by General Electric's worldwide engineering services operations.

When we look to the late 1980s, we become concerned about the possibility of electric power shortages and associated economic dislocations. The nation faces a decade when it will need to create more than 17 million new jobs for the growing number of men and women of working age. Even with our best conservation efforts, economic growth will continue to require increasing energy supplies, and there is no assurance that "alternative" energy sources, most of which General Electric is already working on, will be capable of meeting our nation's energy needs.

Power Systems managers are seeking to bring these concerns to the public's attention. General Electric's view is that economic growth here and elsewhere in the world will continue to require increasing energy supplies. To meet the energy needs of the future will demand intensive development of *all* our energy options, including coal technologies and nuclear power, that can see the United States through the transition to the time if and when such "renewable resources" as solar, biomass and fusion technology become viable.

As reported in previous Annual Reports, customers have required that nuclear fuel be sold with warranties covering the useful life of the fuel, even though the experience base for predicting the life of nuclear fuel under power plant operating conditions is still relatively small. As of December 31, 1978, there were open warranty commitments on fuel with an original sales value of approximately $900 million, and on fuel in the backlog presently valued at $2.9 billion, covering deliveries through the 1980s.

Additionally, fulfillment of a small number of its nuclear fuel orders requires the Company to procure uranium concentrate. General Electric has on hand or under contract sufficient uranium to meet presently-anticipated requirements. Also, some fuel orders include reprocessing, plutonium fabrication and waste disposal services. In view of current United States Government policies, it is highly uncertain whether such services can be provided.

Technical Systems and Materials

(In millions)	1978	1977	1976	1975	1974
Revenues	$4,745	$4,145	$3,688	$3,251	$3,191
Net earnings	278	248	202	160	179

Edward E. Hood, Jr.
Senior Vice President and Sector Executive

Technical Systems and Materials operations had a good year in 1978, with a 14% increase in revenues and a 12% gain in earnings over the 1977 results. Benefiting from high levels of investments in R&D and in plant expansion, the Sector contributed 22% of total GE revenues and 23% of earnings. Our engineered materials businesses grew strongly in both U.S. and international markets. We won a good share of the year's surge in commercial aircraft engine orders, and our industrial and marine applications of jet-engine technology kept growing. In aerospace, we entered the commercial avionics market and expanded our role in aircraft simulators. We did well both in mobile radio and in the expansion of our information services network.

(continued on pages 16-17)

Technical Systems and Materials operations shown above: plastics production facilities at the Mount Vernon, Ind., plant; aircraft engines; aerospace products, including the Nimbus G satellite; medical systems; and information services. Other Sector products include aircraft-derived engines for industrial and marine applications; communications equipment; and batteries.

Engineered materials in 1978 enhanced their role as one of General Electric's strongest growth areas. Earnings in 1978 were significantly higher than 1977 on a good sales increase. The diverse spectrum of GE high-performance materials includes plastics, silicones, tungsten-carbide metals, Man-Made® diamonds and Borazon® abrasives.

Our broad line of engineered plastics had substantially higher earnings on a strong sales increase and improved margins. An important factor was the increased penetration of these materials into the automotive industry, both in the U.S. and abroad. GE plastics such as Lexan® and Noryl® were increasingly specified as replacements for metals because of their strength and cost effectiveness. Specification of GE plastics by auto designers was also spurred by the drive to achieve improvements in fuel efficiencies. Our plastics' attractive strength-to-weight ratios allow them to replace heavier metals with equal or better functional performance.

Investments in manufacturing facilities during 1978 positioned the Company to increase its penetration of world markets for high-performance plastics. At Bergen op Zoom, The Netherlands, improved manufacturing facilities with new environmental protection systems are enabling us to expand European sales of Noryl and Lexan polycarbonate.

Industry's drive to improve productivity benefited our businesses in ultrahard cemented tungsten-carbide metals and Man-Made diamonds for a wide range of metal-cutting tools. Carboloy Systems announced a new high-performance aluminum-oxide-coated cutting insert for machine tools – the ProMax 570® insert – that provides new advances in high-speed cutting capability and metal-removal rates.

Sales of GE's line of rechargeable nickel-cadmium batteries grew faster than the industry in 1978. Orders were strong for our new sealed lead-acid batteries, and we introduced DataSentry® batteries that can be mounted on circuit boards to provide standby power for computers.

The Company's silicone chemicals operations continued to expand both in the U.S. and abroad, with the business in silicone sealants benefiting from earlier investments in sophisticated manufacturing processes at its Waterford, N.Y., facilities.

GE aircraft engine businesses serve aircraft, marine and industrial markets. Better 1978 earnings from higher sales were partially offset by the stepped-up level of expenditures for commercial engine development.

An important breakthrough for us came with the selection by two major airlines, Delta and American, of our CF6-80A engine to power the new twin-engine Boeing 767 aircraft. Selection of this General Electric engine for 50 firm and 42 optioned aircraft made 1978 the most significant year in the CF6's ten-year history, increasing to 692 the number of GE-equipped wide-bodied aircraft selected to date by 59 customers worldwide.

Progress was made on other versions of the CF6 engine. The CF6-32 high-bypass turbofan engine is designed to power new 150- to 180-passenger twinjets and 200-passenger trijets. The GE CF6-45 engine, which powers some 747s, was selected in 1978 to power the new Airbus Industrie A310 jetliners. The CF6 engine family continues to offer airline customers improved fuel consumption and increased engine reliability.

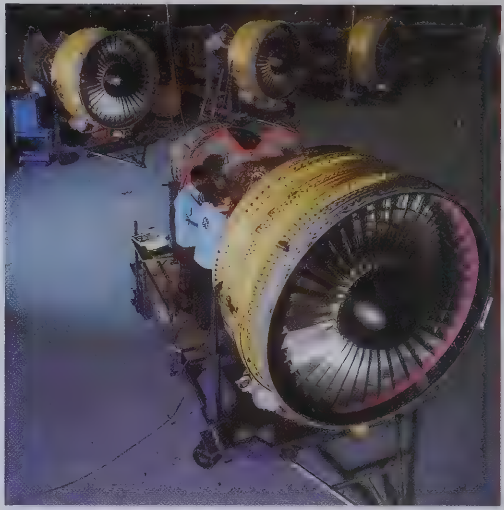
Our CFM56 turbofan engine – a lower-thrust powerplant designed for the next generation of short- and medium-range aircraft and for re-engining of present standard-bodied aircraft – continued its flight testing program in 1978. The CFM56 is a joint development by General Electric and SNECMA of France.

Marine and industrial markets for aircraft-derived engines remained strong during the year. We shipped our first production LM5000 gas generator for industrial use in 1978. It provides the energy for electrical power generation near Tokyo, Japan. Application of these engines continued to broaden – in pipeline pumping, on oil-well-drilling rigs, and to power the new generation of fast vessels for many of the world's navies.

The Company continued its work on both operational and developmental military engines worldwide during the year. A highlight was the successful maiden flight of the F-18 aircraft powered by the GE F404 augmented turbofan engine. Production began on the T700 engine for the U.S. Army's Black Hawk helicopter, while development continued on a variety of other military and commercial applications.

Aerospace earnings, reflecting development expenditures, were down somewhat on a modest sales increase. Included in this business are such high-technology areas as space technology, defense electronics, advanced energy systems, and avionics for both military and commercial aircraft. Highlights of 1978:

• GE was selected to build the next-generation Landsat satellite system, Landsat-D, for NASA. The system will include an advanced spacecraft and a ground data



In production at GE's Evendale, Ohio, plant: the CF6 family of engines chosen by 58 airlines to power their passenger jets.

Penetration of GE plastics into European markets is exemplified by multicolored Fiat auto bumpers molded of Lexan resin.

processing complex to improve observation and inventory of earth's resources.

• Rising aviation fuel costs continue to expand markets for GE simulation products which permit pilots to "fly" realistic training missions in simulators on the ground instead of in actual aircraft. Pilots view moving, full-color scenes of the terrain generated by complex special-purpose computer systems. Advances in realism of the simulated scenes have also led to contracts for training Army tank crews.

• An important commercial avionics application was achieved with the awarding of a contract for a thrust management system for the Boeing 767 aircraft. Other key avionics opportunities are being pursued on this major aircraft program.

Medical systems supplied by GE include diagnostic imaging and patient monitoring equipment and other medical products and services in which GE's technological progress is benefiting the health-care field. Our earlier investments in this business' production facilities and our continued technology development contributed to a year of earnings and sales well above the previous year's level.

The year saw a continued growth in orders for computed tomography (CT) scanners, with significant gains in offshore markets, especially Japan. GE's leadership in advancing CT technology has enabled us to achieve this level of strength in the marketplace.

Our new DataCamera® nuclear diagnostic camera, for accurate measurements of heart functions without invasive procedures, has spearheaded our strong entry into nuclear medicine.

Along with advances in new technologies, General Electric continued to improve its core x-ray product lines. Our new L300 image intensifier, coupled with new table and generator designs, provides fluoroscopic images with less radiation and more detail than many competing systems.

GE's information services business produced substantially higher sales and earnings in 1978. During the year, our worldwide MARK III® remote computing network expanded to Hong Kong, and now serves over 600 metropolitan areas located in 22 countries. Also, at year end, General Electric and Honeywell Inc. combined the worldwide operations of GE's Information Services Division and Honeywell's time-sharing marketing operations that distribute the GE services in the United Kingdom, Europe and Australia. The new company is 84%-owned by General Electric and 16% by Honeywell.

Communications businesses in which General Electric participates include our mobile radio operations and computer interface equipment.

GE's mobile radio business had significantly higher sales and earnings, and reached a milestone in its development on an international scale. This was the introduction of a new FM mobile radio line based on the technologies of both GE and our European affiliate, Storno. With Storno offering the product line in its international markets, GE is also marketing the equipment as the Century® II line, a competitively-priced mobile radio for reliable business communication.

New technology is also being emphasized for our data communication equipment. Added to the line in 1978 was the TermiNet® 200 matrix printer whose computer printout capability delivers speeds of up to 200 characters per second.

The outlook for these diverse businesses is influenced both by technological and economic trends. In terms of technology, 1978 was a year of continued investment for the future, and we have in development for each of these businesses advances aimed at keeping them competitive.

On the economic front:

• A slowing of the U.S. economy during the second half of 1979 would affect our short-cycle materials businesses serving consumer durables markets. However, we would expect the impact to be partially offset by penetration of new markets and new applications, as well as by expansion of our international business.

• With many airlines at the beginning of a new orders cycle to replace aging equipment, we anticipate continued strong demand in commercial aircraft engine markets. Orders for industrial and marine applications also remain at high levels.

• Aerospace businesses sensitive to the volume of Government-contracted projects should reflect the projected modest growth rate in defense spending.

• For our medical systems business, we foresee continued strengths stemming from GE's investments made in prior years. Longer-term national efforts to reduce spiraling medical costs could well be beneficial to the diagnostic imaging business, since this technology is a cost-effective key to better diagnoses that can improve the quality of health care while contributing to lower overall medical expense.

• Markets for information services and mobile radio equipment are expected to continue their growth.

Engineers from both General Electric and Storno, a GE European affiliate, participated in the development of a new mobile radio line combining their technologies.

New, more efficient TC-100 series of Solartron® vacuum tube solar collectors was introduced in 1978 by General Electric's Space Division in Philadelphia, Pa.

Natural Resources

(In millions)	1978	1977	1976	1975	1974
Revenues	$1,032	$965	$1,003	$683	$526
Net earnings	180	196	181	108	97

Alexander M. Wilson
President and Chief Executive Officer
Utah International Inc.

Natural Resources businesses, managed by Utah International Inc., contributed 15% of GE earnings and 5% of revenues in 1978. Despite difficult challenges, earnings declined only 8% from 1977's record high. Serious economic pressures affected Japanese and European steel producers, Utah's principal customers. Australian earnings were restrained by a miners' strike of nearly seven weeks and by higher Australian taxes. Earnings from uranium operations were lower also, and the weak market for output from our Brazilian iron ore operation resulted in a loss. Overall, however, as a low-cost producer of raw materials, we were able to operate effectively in a difficult business climate, and we are well positioned to benefit from any improvement in markets.

The Natural Resources businesses consist primarily of operations of the wholly-owned affiliate, Utah International Inc. Activities of Utah and its affiliates depicted above: the mining of coking coal, iron ore and uranium, the production of oil and gas, and extensive land restoration and exploration projects. Other activities: mining of steam coal and copper, ocean shipping and land development.

Natural Resources revenues were 7% higher in 1978 than in 1977, primarily because of the inclusion of revenues of Marcona Corporation, which became a wholly-owned GE affiliate during the year. Marcona, also engaged in mining and shipping, was formerly 46%-owned by Utah.

Improved earnings from copper and petroleum operations were more than offset by lower earnings from coking coal, uranium and Brazilian iron ore operations.

Approximately 83% of 1978 revenues and 71% of net earnings originated from non-U.S. operations.

At the end of 1978, the mineral sales backlog, including uranium, was $5.8 billion, of which $4.6 billion was scheduled for shipment after 1979. The majority of contracts for this backlog offer substantial protection against future cost increases. Virtually all sales contracts are payable in U.S. dollars.

Australian coking coal activities continued to be Utah's major source of earnings in 1978. Moderating this contribution was the impact of a 5% tax increase imposed by Australia on the taxable incomes of nonresident companies.

Despite reduced requirements, particularly by established Japanese customers, Utah's coking coal sales in 1978 were limited more by product unavailability caused by the miners' strike than by the lack of marketing opportunities. Buoyed by spot sales both to new customers and to some European long-term contract customers, shipments during the first six months reached a record for any half-year period. The strike depressed deliveries in the third quarter, but the record 5 million tons shipped in the fourth quarter brought the 1978 total to about the same as 1977.

Utah's significant position as a coking coal supplier will be expanded when Norwich Park, our fifth surface coking coal mine in Australia, comes into production in late 1979. Additional annual capacity of 4.3 million metric tons will bring total production capacity of the Utah-operated mines to over 21 million metric tons.

To diversify Utah's customer base, new coking coal sales agreements were reached with steel mills in Western and Eastern Europe, Latin America and the Far East. Japanese steel mills continue, however, to be our primary customer and, in December of 1978, Utah negotiated a 27-month sales contract with the Japanese for Blackwater mine coal at terms slightly less favorable than those in the contract which terminated at year end.

Utah owns 89% of Blackwater and 68% of other Utah-operated coking coal mines.

Uranium operations, primarily in the U.S., are conducted by Pathfinder Mines Corporation, a wholly-owned, nonconsolidated subsidiary, all of whose common stock is held by independent trustees. See note 12 to the financial statements for additional information.

Earnings in 1978 were down from 1977, because the 1978 average realized price for uranium oxide was substantially lower. This price decline was due to long-term contract commitments which reduced the proportion of production capacity available for spot sales (usually higher-priced) compared to 1977.

Iron ore operations resulted in a loss for 1978. This was primarily due to the first full year of operations at Samarco, a $600-million Brazilian venture in which Utah owns 49% of the voting stock and has debt guarantees. Samarco's start-up has been technically successful, but coincided with reduced demand for iron ore products worldwide. Profitability of other iron ore operations in the U.S., Australia and New Zealand improved.

Copper activities at the Island Copper mine in British Columbia, Canada, showed a significant turnaround from the loss experienced in 1977. Higher average price realizations for copper and for the two principal byproducts, gold and molybdenum, combined with good mining and milling rates to account for the improvement.

Oil and natural gas operations of wholly-owned Ladd Petroleum Corporation reported higher revenues and earnings. Ladd's exploration and drilling operations have continued to result in good additions to oil and gas reserves—the key to future revenues and earnings growth.

Steam coal mining operations are led by the leased Navajo mine, which fuels the Four Corners Power Plant in New Mexico. The mine's earnings were affected by lower shipments in 1978. The nearby San Juan mine, operated by Utah under contract with the owner, supplies the San Juan Power Plant. Earnings from this mine improved, primarily as a result of a renegotiated contract which provides for increased prices and shipments. Deliveries from our new Trapper mine, located near Craig, Colorado, were substantially below capacity because of construction delays at the new Yampa Power Plant, the principal market for Trapper's coal.

With the capability to load simultaneously two ships of the 100,000-deadweight-ton class, Utah's Hay Point port facility in Queensland, Australia, is one of the world's leading high-capacity coal shipping terminals.

Steam coal for electric power generation is another resource mined by Utah. Shown: operation at Utah's Trapper mine in Colorado.

In other activities, earnings of Marcona Corporation were down, primarily because of lower earnings from a purchase and resale agreement for Peruvian iron ore pellets. Utah's land development operations had improved earnings.

The outlook: We are a low-cost producer with substantial natural resource capability vital to international economic development. Utah's operating and management expertise places us in the forefront of international mining activities. These combined strengths support an optimistic view of the future.

International

Foreign multi-industry operations (In millions)	1978	1977	1976	1975	1974
Revenues	$2,767	$2,562	$2,334	$2,198	$1,860
Net earnings	78	71	75	58	59

U.S. exports — all Sectors (In millions)	1978	1977	1976	1975	1974
Sales	$2,571	$2,101	$1,915	$1,638	$1,475

John F. Burlingame
Senior Vice President and Sector Executive

The International Sector in 1978 made progress in each of its areas of responsibility. The Sector continued to work with the other Sectors to develop and implement their international business strategies. Export sales showed a particularly strong rise, as many GE operations utilized the Sector's international marketing and sales capabilities. Foreign multi-industry operations reported improved results overall, and accounted for 13% of GE's total revenues and 6% of earnings despite depressed economic conditions in many of their host countries. Investment positions in several of these businesses were realigned during the year for greater future returns.

The International Sector's role in marketing U.S. exports is exemplified by GE-powered ship, steel mill drives and gas turbines. The Sector also manages diversified multi-industry foreign affiliates that manufacture varied lines of products ranging from large electrical apparatus in Brazil to Hotpoint® appliances produced by Canadian GE's affiliate, Canadian Appliance Manufacturing Company Limited.

The total international business of the Company includes the diversified multi-industry operations assigned to the International Sector, U.S. exports by all Sectors, sales by nondiversified affiliates assigned to their appropriate Sectors, and offshore business conducted by Utah International. Together, these businesses accounted for about 33% of General Electric revenues in 1978, as detailed on page 44.

Foreign multi-industry operations which are the direct responsibility of the International Sector consist principally of affiliates manufacturing varied lines of products oriented toward their host-country markets. Foreign multi-industry operations increased revenues 8% and earnings 10% in 1978, including good improvements in international construction operations and most Latin American affiliates.

- Construction operations, which provide the management and technical expertise to take on very large international projects, maintained their rapid growth. The International Projects Department provides system engineering and construction supervision for projects such as complete power plants, while our construction affiliates, operating in the Middle East, Africa and Latin America, have the capability for civil works and installations associated with major electric utility and industrial projects. A significant portion of General Electric export sales in developing countries is dependent on this capability.
- Latin American manufacturing affiliates, overall, showed a strong performance. Our Venezuelan affiliate continued its growth, and we invested in upgrading its facilities. GE-Mexico also improved its results, maintaining its steady comeback from the effects of the 1976 peso devaluation. For our Brazilian affiliate, 1978 was an off year, with heavy goods manufacture in particular showing a decline.
- Canadian General Electric Company Ltd. (CGE) improved its earnings despite a year of no sales growth, resulting from sluggishness of the Canadian economy. The gain in earnings reflected, in part, the good performance of the new Canadian Appliance Manufacturing Company Limited, established in 1977 to merge the appliance operations of CGE with those of two other producers in order to improve our position in Canada's consumer goods markets. The new company overcame anticipated start-up difficulties and improved its earnings in 1978 – a notable achievement in so short a time.
- Affiliates in Europe, the Middle East and Africa continued to help "pull through" substantial U.S. export orders. Manufacturing operations in Italy reported an increased loss in 1978.
- General Electric affiliates in Australia again encountered depressed market conditions, while those in the Philippines were able to take advantage of strong market growth.

U.S. export sales to external customers, which are included in their appropriate Sectors, were up strongly in 1978, totaling \$2.6 billion, compared with \$2.1 billion in 1977. With five Sectors participating, the year's increases in exports were led by aircraft engines and gas turbines. Some \$1,662 million of the 1978 total came from exports to Europe/Africa/Middle East areas, while sales to customers in the Far East and Australia totaled \$498 million. Exports to other areas totaled \$411 million. The International Sector provides the worldwide sales structure supporting the marketing of these exports.

The outlook is for continued growth in international markets. Many international markets served by GE have tended to grow faster than those in the U.S. Many countries, especially the developing countries, are modernizing elements of their infrastructures, such as electric power, transportation, communications and health services, and these comprise a good match for GE technologies. Strategic planners of GE operations are, with the assistance and support of the International Sector, effectively identifying these opportunities and allocating the resources to capitalize on them.

The U.S. Government can do much to improve the prospects of U.S.-based international companies simply by further recognizing the importance of international trade and investment. The urgent need is for consistent ground rules that give U.S. companies parity with foreign competitors. This means a U.S. foreign economic policy that removes present disincentives, that recognizes the important relationship of foreign investment to increased trade, and that establishes new procedures to facilitate exports. Also important is successful U.S. participation in the GATT negotiations in order to reduce the tax and nontariff barriers that limit U.S. manufacturers' access to foreign markets.

In 1978, we saw encouraging signs that this change in perception is taking place. Congress continued the DISC tax incentives for export sales, as well as the deferral of American taxes on unremitted income of foreign subsidiaries of U.S. companies – both of which help match, to some degree, the support that other countries provide their international companies. Also, the Administration took some first steps toward the development of consistent support for U.S. foreign trade growth.

These changes in perspective and policy are important not merely to General Electric and other international companies. Such changes are the key to maintaining the one in every nine U.S. manufacturing jobs that is dependent on export trade and foreign investment, as well as to reducing the serious deficits in the U.S. trade balance and to strengthening the U.S. dollar.

Ore grinding equipment, such as this massive ball mill end produced by the Dominion Engineering Works of Canadian General Electric, is produced for export to mining operations in many parts of the world.

At the site of the Guri Dam in Venezuela, SADE-Venezuela, an International Construction Division affiliate, is providing the electrical substation and a concrete batching plant for construction that will quadruple the dam's present capacity.

Research and development

General Electric in 1978 positioned itself to enhance future profitability by making record investments in research and development as well as in the modernization and expansion of plant and equipment.

The Company supported its R&D efforts with a record level of expenditures. The total of $1,270 million spent on research and development during the year included a Company-funded portion of $521 million, substantially above 1977. The remaining $749 million, also a record, was performed under contract, primarily for agencies of the United States Government.

A review of GE technology was implemented in 1978. The objectives of this Corporate Technology Study were to appraise the present status of technology throughout the Company, to anticipate future directions, and to strengthen GE's thrust in new areas judged to have high technological potential. An important element of the Study was an appraisal of the Company's technical manpower programs, with the objective of strengthening GE's capability to attract and develop high-caliber technical people.

The Corporate Technology Study examined the technological strengths of 32 General Electric business areas and evaluated them against their strongest competitors worldwide. This analysis confirmed the strong position of the Company's technology and also documented the fact that General Electric businesses ranking best in competitive technical strengths have been most profitable.

To help bring all GE businesses up to this top ranking, the Company in 1978 implemented an even closer integration of technology with strategic planning to guide the Company's allocation of resources for technology. In addition, new manpower programs were introduced to further strengthen General Electric recruitment of technical people, and the development of their career opportunities and management skills.

A Companywide focus for GE technology is provided by the GE Research and Development Center in Schenectady, N.Y., employing some 800 scientists and engineers, plus a supporting staff of nearly 1,200, in the search for new knowledge across the whole spectrum of disciplines important to GE businesses. In addition, the Company conducts development projects at more than 100 laboratories associated with operating components. All in all, 15,000 technical-degree holders at General Electric are engaged in science and engineering, with a similar number employed as manufacturing, sales and service engineers.

A sampling of 1978 programs indicates the scope of General Electric R&D work:

- Power from coal – Long-duration test runs were made with an integrated coal gasification/combined-cycle pilot plant, which contains all essential elements of an eventual full-scale facility for converting coal into electricity cleanly and efficiently.
- New materials – A proprietary new engineering thermoplastic, X-76, has been developed, providing a high-strength, lightweight metal substitute. The new material is flame-resistant and withstands temperatures 100°F higher than any other General Electric plastic.
- Quieter aircraft engines – For the first time, aerodynamic conditions have been achieved in a laboratory acoustic facility that closely approximate those of a jet airplane in flight. The facility now is being used to develop quieter jet engines.
- Health-care technology – New software developments are being evaluated for computed tomography scanners to be used in providing nonsurgical postoperative tests to determine the success of coronary bypass surgery.
- Electronics advances – The world's most efficient high-power transistor has been developed and will be applied to electric vehicle control. It is designed to provide smooth regulation of speed and efficient regenerative braking.

Plant and equipment investments to provide for the growth of the Company's high-technology businesses and to improve productivity rose to a new high of $1,055 million, up 28% from the 1977 level.

The year's expenditures for expanding plant capacity were led by investments to facilitate the growth of such businesses as high-performance plastics and aircraft engines. Other investments to increase productivity and capacity represented a substantial portion of the total.

Energy projects have a high priority, as exemplified by research on an advanced battery that is being developed to help utilities meet peak demands for electricity. This effort is supported in part by the Electric Power Research Institute, the R&D arm of the nation's electric utility industry.

The quest for better materials goes on. Scientists and engineers at the R&D Center are investigating amorphous metals, a revolutionary new class of materials with unique magnetic and physical properties that could yield far more efficient electric motors and transformers.

Board of Directors

In addition to its ten regular meetings and the numerous meetings of its Committees during 1978, the Board of Directors conducted a business review which included reports on GE operations in the United Kingdom, Western Europe, Eastern Europe, the Middle East and Africa.

The Directors also participated in GE Centennial activities, including a customer dinner and the 1978 Information Meeting in October in New York City.

The regular quarterly dividend was increased by the Board in May of 1978 by 18%, from 55 to 65 cents per share.

The Board is made up primarily of Directors from outside the Company. Only four are members of GE management; the other 16 Directors have earned positions of leadership in such fields as business, law, education, finance and public service. The listing of Directors below is in order of their Board seniority, with the year in which they were first elected shown in parentheses.

Frederick L. Hovde, President Emeritus, Purdue University, Lafayette, Ind. (1956)

John E. Lawrence, President, James Lawrence & Co., Inc., cotton merchants, Boston, Mass. (1957)

Walter B. Wriston, Chairman of the Board and Director, Citicorp and Citibank, N.A., New York, N.Y. (1962)

Ralph Lazarus, Chairman of the Board and Director, Federated Department Stores, Inc., Cincinnati, Ohio. (1962)

Gilbert H. Scribner, Jr., Chairman of the Board and Director, Scribner & Co., real estate and insurance, Chicago, Ill. (1962)

Edmund W. Littlefield, Chairman of the Board and Director, Utah International Inc., San Francisco, Calif. (1964)

J. Paul Austin, Chairman of the Board and Director, The Coca-Cola Company, Atlanta, Ga. (1964)

Jack S. Parker, Vice Chairman of the Board, Executive Officer and Director, General Electric Company, Fairfield, Conn. (1968)

Reginald H. Jones, Chairman of the Board, Chief Executive Officer and Director, General Electric Company, Fairfield, Conn. (1971)

Walter D. Dance, Vice Chairman of the Board, Executive Officer and Director, General Electric Company, Fairfield, Conn. (1971)

James G. Boswell II, President and Director, J. G. Boswell Company, farming and related businesses, Los Angeles, Calif. (1971)

Charles D. Dickey, Jr., Chairman of the Board, President and Director, Scott Paper Company, Philadelphia, Pa. (1972)

Henry L. Hillman, President and Director, The Hillman Company, diversified operations and investments, Pittsburgh, Pa. (1972)

Henry H. Henley, Jr., President and Director, Cluett, Peabody & Co., Inc., manufacturing and retailing of apparel, New York, N.Y. (1972)

Silas S. Cathcart, Chairman of the Board and Director, Illinois Tool Works Inc., diversified products, Chicago, Ill. (1972)

Samuel R. Pierce, Jr., Partner, Battle, Fowler, Jaffin, Pierce & Kheel, law firm, New York, N.Y. (1974)

Gertrude G. Michelson, Senior Vice President, Employee and Consumer Relations, Macy's-New York, retailers, New York, N.Y. (1976)

Lewis T. Preston, President and Director, J. P. Morgan & Co. Incorporated and Morgan Guaranty Trust Company, New York, N.Y. (1976)

George M. Low, President, Rensselaer Polytechnic Institute, Troy, N.Y. (1977)

Richard T. Baker, Consultant to Ernst & Ernst, public accountants, Cleveland, Ohio. (1977)

Board Committees: New Nominating Committee assesses Director candidates, Committee memberships

Members of the Nominating Committee, left to right, front row: Henry H. Henley, Jr., Chairman; J. Paul Austin, James G. Boswell II. Back row: Charles D. Dickey, Jr., Ralph Lazarus, Edmund W. Littlefield.

The Committee structure of the Board was strengthened further in 1978 by the formation of a Nominating Committee, which will concentrate specifically on Board succession and organization.

The Nominating Committee, supplementing the work of the six other Committees of the Board summarized on pages 24 and 25, is composed of the Chairmen of these other Board Committees.

The new Committee's responsibilities include the selection of potential candidates for Directorships and the recommendation of Director candidates to the full Board of Directors. The Nominating Committee also makes recommendations to the full Board concerning the structure and membership of each of the other six Board Committees for the ensuing year.

Henry H. Henley, Jr.

Henry H. Henley, Jr., Chairman

(Committees of the Board continued on pages 24-25)

Operations Committee: the Board's monitor of GE operating performance

Members, left to right, front row: J. Paul Austin, Chairman; Jack S. Parker, Vice Chairman; Gertrude G. Michelson. Back row: James G. Boswell II, Lewis T. Preston, Gilbert H. Scribner, Jr.

The members of this Committee see it as our function to extend the Board's reach by giving special attention to General Electric's operations. Our concern is to make sure that operating matters posing particular challenges and opportunities are brought before the full Board in a timely manner.

In view of the Company's growth in international markets, we continued in 1978 to give special emphasis to overseas businesses. We reviewed with the appropriate managers the Company's offshore sourcing operations. Our review included the strategic planning for these operations, the production resources allocated to them, and the planning for control and management of the financial risks involved.

In line with our interests, the full Board in April conducted a business review of the Company's activities in Europe, Africa and the Middle East.

Joint meetings with other Committees during the year gave us the opportunity to review the implementation of the Corporate Technology Study and to study drafts of the Company's Annual Report and proxy materials.

The members of this Committee come from widely varied business backgrounds. We see this diversity as an advantage allowing us to apply an independent and broadly experienced perspective to operating matters, helping to assure that General Electric performs responsibly in the interests of the share owners and the public as a whole.

J P Austin

J. Paul Austin, Chairman

Technology and Science Committee: seeking the greatest potential from GE research and development

Members, left to right, front row: James G. Boswell II, Chairman; Jack S. Parker and Walter D. Dance, Vice Chairmen; Silas S. Cathcart. Back row: Henry L. Hillman, Frederick L. Hovde, Edmund W. Littlefield, George M. Low.

With the strong approval of this Committee, General Electric has, in its Corporate Technology Study, made an exhaustive effort to appraise the present status of its technology and to anticipate future directions, needs and opportunities.

Having reviewed the final phases of this Study at the end of 1977, the Committee followed up in 1978 by examining the Study's implementation. We satisfied ourselves that the many "action recommendations" are already having impact in building technological strengths that will make GE businesses more competitive, and in shaping manpower programs that offer greater incentives and opportunities for technical creativity.

Our ongoing work included conducting our own independent assessments of the vitality and quality of GE research and development activities. We continued to use the Board's reviews with Sector Executives as opportunities to inquire into specific technologies we consider essential to each Sector's progress.

We remain mindful, as the share owners' representatives, that General Electric is a company based on technological innovation and product leadership. The reviews we conducted in 1978 assured us that GE is maintaining vigorous development programs in the areas of greatest potential to the Company and to society and that, by carrying through its Corporate Technology Study, management has taken responsible action aimed at further strengthening General Electric's technological thrust in the future.

James G. Boswell II

James G. Boswell II, Chairman

Management Development and Compensation Committee: maintaining the quality of GE managerial leadership

Members, left to right, front row: Ralph Lazarus, Chairman; J. Paul Austin, Silas S. Cathcart. Back row: John E. Lawrence, Walter B. Wriston.

Only nonemployee Directors serve on this Committee, which has two principal responsibilities entrusted to it by the Board: to monitor and evaluate officer-level appointments and succession planning; and to review changes in executive compensation and in the plans by which GE seeks to attract, retain and motivate key employees.

During 1978, we met with the Chairman of the Board to review his appraisals of key executives' performance. Independently and separately, we conducted an assessment both of his appraisals and of his own performance. The Board's business reviews, customer relations activities and other events enabled us to develop firsthand knowledge of GE executives and their potentials for increased responsibility. We reviewed the status and depth of the Company's executive resources with the Chairman and with the Vice President – Executive Manpower.

We acted in support of the Board's longstanding position that nonemployee Directors should determine the compensation and benefit plans appropriate to the executive group. As an example, the Stock Option/Performance Unit Plan was developed through several working sessions of the Committee, and our modifications were incorporated by the Board in the final plan which was submitted to, and approved by, the share owners in 1978. Again, we met regularly with the Chairman to review and decide such matters as executive salaries, option grants, compensation plan awards and executive pensions.

Ralph Lazarus

Ralph Lazarus, Chairman

Public Issues Committee: assuring a thoughtful GE voice on key issues

Members, left to right, front row: Henry H. Henley, Jr., Chairman; Walter D. Dance, Vice Chairman; Gertrude G. Michelson, Richard T. Baker. Back row: Henry L. Hillman, Ralph Lazarus, Samuel R. Pierce, Jr.

News headlines have made clear the powerful negative effects that societal, regulatory, economic and political issues can have on business. Yet other news stories have underscored the benefits that can accrue when business leaders speak out effectively on key public issues such as capital formation, tax legislation, regulatory excesses and overseas investments.

In this climate, the members of the Board's Public Issues Committee see our role as two-fold: to provide an independent checkpoint on the issues – present or potential – that affect General Electric; and to appraise the effectiveness of management's response.

On the basis of our assessments in 1978, we are assured that the Company has in place the procedures essential for issue identification, analysis and strategy development, and for implementation of coordinated internal and external communications programs. These procedures are working, and GE's voice on key issues is being heard.

For the past several years, we have stayed particularly alert to changes in Governmental regulations that affect business. Our reviews have covered the Company's compliance with regulations in the areas of occupational safety and health, product safety, and equal opportunity. On this last issue, we welcomed the 1978 conciliation agreement reached with the U.S. Equal Employment Opportunity Commission. We agree that this settlement can be implemented as a fresh opportunity for affirmative actions in support of the Company's equal opportunity goals.

Henry H. Henley, Jr.

Henry H. Henley, Jr., Chairman

Finance Committee: appraisal of GE financial planning

Members, left to right, front row: Edmund W. Littlefield, Chairman; Reginald H. Jones, Vice Chairman; Charles D. Dickey, Jr., Henry H. Henley, Jr. Back row: Lewis T. Preston, Gilbert H. Scribner, Jr., Walter B. Wriston.

A typical agenda for the Finance Committee begins with a report on the Company's financial position, moves to reviews of GE's investments in foreign companies and its exposure in terms of foreign currency, and includes reports on the operations of the General Electric Credit Corporation, on purchases of debentures for sinking fund purposes, and on GE Pension Trust operations. The agenda also includes discussion of new business ventures or other matters involving large-scale utilization of Company funds.

There is a good reason why we on the Finance Committee give close attention to matters such as these: they represent financial situations that, if not properly managed, could have a disproportionate "swing" effect on the Company's financial results. The Board expects us to monitor these situations, using the strong financial and business experience of our members to anticipate potential problems and see that appropriate strategies are developed early enough to deal with them.

Joint meetings with other Committees broaden our opportunities to examine the financial aspects of the Company's programs and plans. In February, as an example, we shared in the review of the Company's Annual Report and proxy materials.

General Electric's financial strengths are a great resource. We see it as our special province to help assure that this resource is used wisely, prudently and responsibly in the interests of share owners and of society generally.

Ed Littlefield

Edmund W. Littlefield, Chairman

Audit Committee: independent assessments of audits of GE

Members, left to right, front row: Charles D. Dickey, Jr., Chairman; Richard T. Baker, Frederick L. Hovde. Back row: John E. Lawrence, George M. Low, Samuel R. Pierce, Jr.

The Audit Committee, which includes only Directors from outside the Company, maintains an ongoing appraisal of the effectiveness of audits and the independence of the public accountants. It recommends, for approval by the full Board and the share owners, the appointment of the independent public accountants. It also reviews accounting principles and internal accounting controls, and the Annual Report and proxy materials.

In February, May and September, 1978, the Committee met with partners of Peat, Marwick, Mitchell & Co. At the February meeting, we reviewed the firm's audit for 1977, and inquired into the degree of cooperation received from General Electric in carrying out the audit. In May, we reviewed the organization and makeup of the firm's audit team assigned to GE, its plan for conducting the 1978 audit, and other services to be provided.

At our May and September meetings, we also met with the manager of GE's corporate audit staff to review the organization and scope of the Company's own internal audits.

On the basis of these reviews, we were able to report with confidence to the full Board that the resources allocated to the audit function both by the independent auditors and by General Electric itself are adequate to provide the assurances required by the Board.

We conducted a number of other reviews, including a meeting with the Senior Vice President – Finance and the Senior Vice President – General Counsel and Secretary to examine the results of reviews and audits covering the compliance of employees with key GE policies.

Charles D. Dickey Jr.

Charles D. Dickey, Jr., Chairman

General Electric people

GE's U.S. employment, including Utah International's domestic employees, totaled 284,000 at the end of 1978, compared with 279,000 at the end of 1977.

Analysis of domestic General Electric and General Electric Credit Corporation employment for the year ended September 30, 1978, shows continued progress in equal employment opportunities for women and minorities. The number of women managers increased 15%, from 995 to 1,145, and the number of minority managers was up 12%, from 1,079 to 1,206. Women professionals increased 18%, from 3,413 to 4,027, and minority professionals were up 14%, from 2,598 to 2,953.

In categories other than managers and professionals, women and minorities also continued to make gains, with women holding 36% of these jobs and minorities 14%. Overall, women account for 29% of total GE employment and minorities 12%.

An agreement was reached with the Equal Employment Opportunity Commission (EEOC) on June 15, 1978, in settlement of a 1973 charge. The agreement recognizes the vigorous efforts made by the Company over many years to provide equal employment opportunities, formalizes a number of General Electric programs, activities and commitments, and sets a positive pattern for future action. Among key elements of the agreement are expanded training programs for hourly employees, an open promotion system, a promotion incentive program for women and minorities, and wage structure modifications.

Wages and benefits were improved in 1978. Pay increases for hourly manufacturing and salaried employees covered by most union contracts amounted to a minimum of 48 cents per hour (including cost-of-living adjustments), keeping them ahead of inflation for the current contract. Comparable increases were received by other GE employees. In addition, benefits such as pensions, life insurance, weekly sickness and accident plans, savings, and other programs for employees were automatically improved, since most benefits in GE are directly tied to pay levels.

The major union contracts covering most hourly employees expire June 30, 1979. The Company is already preparing for the negotiation of new agreements with the unions.

Affirmative action plans to hire veterans are in place at each Company business location. As a result of such programs, 12% of all persons hired by General Electric in 1977 and the first three quarters of 1978 were veterans. In addition, GE was one of the first companies to step forward in support of President Carter's special program – called HIRE – to help reduce unemployment among minority and disabled veterans. GE pledged to hire 500 veterans in those high-unemployment categories, and as of September 30, when the program ended, the Company had exceeded its pledge three times over.

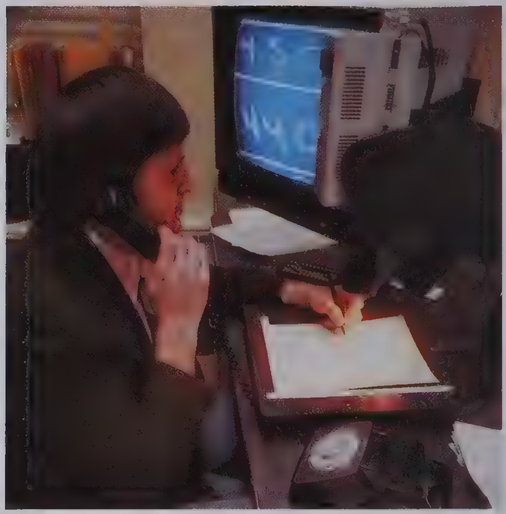
All GE locations also have affirmative action plans to employ the handicapped.

Apprentice programs were in place at 27 Company locations at the end of the third quarter of 1978, with a total of 996 employees participating in 18 different training options, up 7% from the 928 participants at the end of the third quarter of 1977. Of the total, 13% were women and 9% minorities. And a total of 288 apprentices were working toward college degrees as part of their apprenticeship.

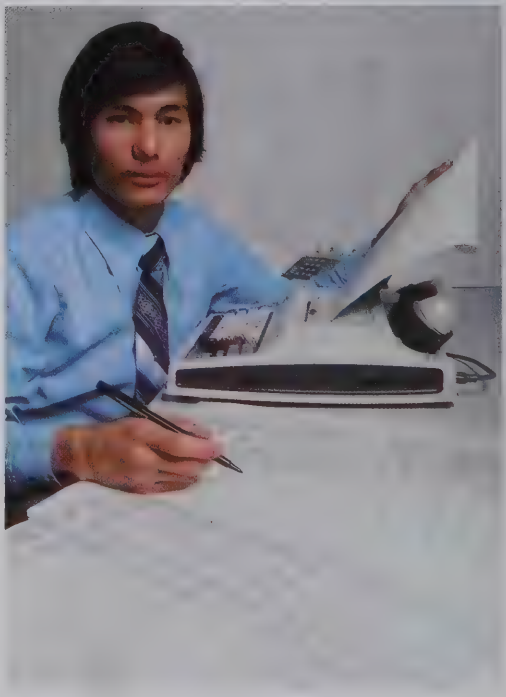
General Electric continued to support the national effort to increase the number of minority engineering graduates, a program pioneered by the Company in 1972.

GE's occupational safety and health record and experience continue to compare favorably with national statistics for companies in the same lines of business. In 1978, in response to the national focus on potential health and environmental risks from chemicals, GE established procedures specifically providing for evaluation and processing of pertinent information received from employees.

Grants to education by the General Electric Foundation totaled $4.3 million in 1978. The Foundation maintained its substantial funding of minority engineering education and equal opportunity programs, as well as of science, engineering and technology, and business-societal-governmental relationships programs. The annual report of the Foundation will be available in April upon request.



At the Fort Wayne, Ind., operation of the Hermetic Motor Department, Neil Waltenburg, who has been legally blind since a 1973 illness, carries out his duties as a production control specialist with the help of special magnifying equipment.



An Edison Engineering Program member, Joseph Ho Lung, shown in Schenectady, is receiving advanced training in technical work. The new GE training program recruits engineering and science graduates.

Management

The team of 127 managers presented on this and the following two pages provides managerial leadership for General Electric.

Integration of the programs and plans of these senior managers is aided by two top-level boards. The Corporate Policy Board is made up of the Chairman, Vice Chairmen and the six officers presented at right. These same officers are joined by the six Sector Executives, pictured earlier in this Annual Report with their respective Sector reviews, to form the Corporate Executive Council.

To provide management for the Company's future, General Electric continued in 1978 to conduct a diverse program of learning opportunities, centered in General Electric's Management Development Institute at Crotonville, N.Y., where over 3,500 employees attended management and professional educational programs during the year.

Two professional employee training programs were developed in 1978 as an outgrowth of the Companywide Corporate Technology Study's appraisal of General Electric's technical manpower recruitment and development:

• Edison Engineering Program. Created to provide a corporate focus on increasing technical competence and leadership in the Company, the Edison Engineering Program is designed to give breadth and depth to an individual's technical experience while opening new career perspectives. The Program recruits outstanding engineering and science graduates, who receive varied work assignments combined with applied engineering problem-solving studies and opportunities for graduate study. This advanced training qualifies participants in the full spectrum of technical work – producing new and improved products, and developing and applying processes, systems, and state-of-the-art technologies. Program graduates are prepared for future technological leadership in the Company.

• Professional Employee Management Course (PEM). This course is designed to provide direction for newly-appointed GE managers in helping their professional employees pursue careers that lead to increased contribution, achievement and personal satisfaction.

Arthur M. Bueche
Senior Vice President, Corporate Technology

Robert R. Frederick
Senior Vice President, Corporate Planning and Development

Robert B. Kurtz
Senior Vice President, Corporate Production and Operating Services

Leonard C. Maier, Jr.
Senior Vice President, Corporate Relations

Walter A. Schlotterbeck
Senior Vice President,
General Counsel and Secretary

Alva O. Way
Senior Vice President, Finance

Management

Corporate Policy Board

Reginald H. Jones
Chairman of the Board and Chief Executive Officer

Walter D. Dance
Vice Chairman of the Board and Executive Officer

Jack S. Parker
Vice Chairman of the Board and Executive Officer

Arthur M. Bueche
Senior Vice President
Corporate Technology

Robert R. Frederick
Senior Vice President
Corporate Planning and Development

Robert B. Kurtz
Senior Vice President
Corporate Production and Operating Services

Leonard C. Maier, Jr.
Senior Vice President
Corporate Relations

Walter A. Schlotterbeck
Senior Vice President
General Counsel and Secretary

Sector Executives

John F. Burlingame
Senior Vice President and Sector Executive
International Sector

Stanley C. Gault
Senior Vice President and Sector Executive
Industrial Products and Components Sector

Edward E. Hood, Jr.
Senior Vice President and Sector Executive
Technical Systems and Materials Sector

Operations

International Sector

James R. Birle
VP & General Manager
Far East Area Division

Willis E. Forsyth
VP & General Manager
Latin American Operations

Frank D. Kittredge
VP & General Manager
Latin American Business Development Division

Paolo Fresco
VP & General Manager
Africa/Middle East Area Division

Alastair C. Gowan
VP & General Manager
Europe Area Division

George J. Stathakis
VP & General Manager
International Trading Services Operations

Kristian H. Christiansen
VP & General Manager
Export Sales and Services Division

Edward F. Roache
VP & General Manager
International Construction Division

Alton S. Cartwright
Chairman of the Board & Chief Executive Officer
Canadian General Electric Company Limited (an affiliate of General Electric)

Industrial Products and Components Sector

James P. Curley
VP & Group Executive
Industrial Products Group

Eugene J. Kovarik
VP & General Manager
Motors and Drives Division

William Longstreet
VP & General Manager
Contractor Equipment Division

Van W. Williams
VP & Group Executive
Component Products Group

George B. Farnsworth
VP & General Manager
Appliance Components Division

Erwin M. Koeritz
VP & General Manager
Electronic Components Division

Ralph B. Glotzbach
VP—Industrial Products and Components Customer and Industry Relations Operation

Kertis P. Kuhlman
VP & General Manager
General Electric Supply Company Division

James M. McDonald
VP & General Manager
Apparatus Distribution Sales Division

Donald E. Perry
VP & General Manager
Industrial Sales Division

Carl J. Schlemmer
VP & General Manager
Transportation Systems Division

Peter C. Van Dyck
VP & General Manager
Apparatus Service Division

Technical Systems and Materials Sector

Charles R. Carson
VP & Group Executive
Engineered Materials Group

Donald E. Debacher
VP—Special Projects

Donald K. Grierson
VP & General Manager
Metallurgical Division

Glen H. Hiner
General Manager
Plastics Division

Daniel J. Fink
VP & Group Executive
Aerospace Group

Lee L. Farnham
VP & General Manager
Space Division

Charles W. George
VP & General Manager
Aircraft Equipment Division

Otto Klima
VP & General Manager
Re-entry and Environmental Systems Division

Thomas I. Paganelli
VP & General Manager
Electronic Systems Division

Donald S. Bates
VP & General Manager
Information Services Division

Christopher T. Kastner
VP & General Manager
Mobile Communications Division

Fred O. MacFee, Jr.
VP & Group Executive
Aircraft Engine Group

Robert H. Goldsmith
VP—Aircraft Engine Strategic Planning and Development Operation

James N. Krebs
VP & General Manager
Military Engine Projects Division

Raymond F. Letts
VP & General Manager
Aircraft Engine Manufacturing Division

Brian H. Rowe
VP & General Manager
Aircraft Engine Engineering Division

Louis V. Tomasetti
VP & General Manager
Airline Programs Division

Edward Woll
VP—Aircraft Engine Project and Technology Assessment

James E. Worsham
VP & General Manager
Commercial Engine Programs Division

Walter L. Robb
VP & General Manager
Medical Systems Division

Corporate Staff Officers

Michael G. Allen
VP—Corporate Strategy

R. Howard Annin, Jr.
VP—Northeastern Regional Relations

Thomas R. Casey, M.D.
VP & Company Medical Director

Lester W. Dettman
VP—East Central Regional Relations

Frank P. Doyle
VP—Corporate Employee Relations

Theodore P. LeVino
VP—Executive Manpower

Edward H. Malone
VP—Trust Investments Operation

Terence E. McClary
VP—Corporate Financial Administration

John B. McKitterick
VP—Corporate Development

Charles J. Meloun
VP—Central Regional Relations

Donald D. Scarff
VP—Atlantic Regional Relations

Roland W. Schmitt
VP—Corporate Research and Development

Cecil S. Semple
VP—Corporate Customer Relations

Thomas O. Thorsen
VP & Comptroller

Russell E. Whitmyer
VP & Treasurer

Alva O. Way
Senior Vice President
Finance

Thomas A. Vanderslice
Senior Vice President and Sector Executive
Power Systems Sector

John F. Welch, Jr.
Senior Vice President and Sector Executive
Consumer Products and Services Sector

Power Systems Sector

Roy H. Beaton
VP & Group Executive
Nuclear Energy Group

William A. Anders
VP & General Manager
Nuclear Energy
Products Division

A. Philip Bray
VP & General Manager
Nuclear Energy
Projects Division

Henry E. Stone
VP & General Manager
Nuclear Energy
Engineering Division

Bertram Wolfe
VP & General Manager
Nuclear Energy
Programs Division

Herman R. Hill
VP & Group Executive
Turbine Group

George B. Cox
VP & General Manager
Large Steam Turbine-Generator Division

George H. Schofield
VP & General Manager
Industrial and Marine
Steam Turbine Division

John A. Urquhart
VP & General Manager
Gas Turbine Division

Donald C. Berkey
VP & General Manager
Energy Systems and
Technology Division

Richard W. Kinnard
VP & General Manager
Switchgear and
Distribution Transformer
Division

Arthur E. Peltosalo
VP—Special Projects

Bruce O. Roberts
VP & General Manager
Large Transformer
Division

Edward W. Springer
General Manager
Electric Utility Sales
Division

William R. Tackaberry
VP—Power Systems
Customer and Industry
Relations Operation

Charles C. Thomas
VP & General Manager
Installation and Service
Engineering Division

Consumer Products and Services Sector

James A. Baker
VP & Group Executive
Lighting Group

Paul L. Dawson
VP & General Manager
Lamp Components
Division

Ralph D. Ketchum
VP & General Manager
Lamp Products Division

Donald W. Lynch
VP & General Manager
Air Conditioning Division

Paul W. Van Orden
VP & General Manager
Housewares and Audio
Division

John W. Stanger
President &
General Manager
General Electric Credit
Corporation (GECC)
(an affiliate of General
Electric)

Lawrence A. Bossidy
VP & General Manager
GECC Commercial and
Industrial Financing
Division

Raymond F. Pettit
VP & General Manager
GECC Consumer
Financing Division

Richard O. Donegan
VP & Group Executive
Major Appliance Group

Donald S. Beilman
VP & General Manager
Major Appliance
Applied Research
and Engineering Division

Robert E. Fowler, Jr.
VP & General Manager
Major Appliance
Manufacturing Division

Richard T. Gralton
VP & General Manager
Major Appliance
Sales and Distribution
Operations

Arthur E. Andres
VP & General Manager
Major Appliance
Contract Sales Division

William B. Clemmens
VP—Major Appliance
Customer and Industry
Relations Operation

Philip J. Drieci
VP & General Manager
Major Appliance
Retail Sales Division

Wayman O. Leftwich, Jr.
VP & General Manager
Major Appliance
Marketing Division

Thomas K. Edenfield
VP—Southeastern
Regional Relations

Douglas S. Moore
VP—Corporate Public
Relations

James F. Young
VP—Technical
Resources

William B. Frogue
VP—Southwestern
Regional Relations

J. Russell Mudge
VP—Corporate
Operating Services

Marion S. Kellogg
VP—Corporate
Consulting Services

Gerhard Neumann
VP—Special Projects

Harry M. Lawson
VP—Western Regional
Relations

Phillips S. Peter
VP—Washington
Corporate Office

Utah International Inc.

Edmund W. Littlefield
Chairman of the Board

Alexander M. Wilson
President and Chief Executive Officer

Utah International Inc.

Alf E. Brandin
Senior VP & Manager
Land Development

James T. Curry
Financial VP &
Treasurer

W. Drew Leonard
Vice President

J. Boyd Nielsen
VP & Controller

Charles K. McArthur
Senior VP & Manager
Mining Division

Boyd C. Paulson
Vice President

George W. Tarleton
VP & Manager, Mineral
Products Marketing

Robert O. Wheaton
VP & Manager
Exploration

John H. Moore
President, Ladd
Petroleum Corporation
(a subsidiary of Utah)

Keith G. Wallace
Senior VP & Manager
Australasia Division

Ralph J. Long
Senior VP & Manager
Australian Operations

Timothy R. Winterer
VP & General Manager
Utah Development
Company (a subsidiary
of Utah)

Bruce T. Mitchell
Secretary

J. Gilbert Selway
General Counsel

Financial issues

Corporate governance covers many activities which encompass financial accounting and reporting. Debate continues over such issues as independence of public accountants, adequacy of financial reporting, and responsibility for establishing accounting standards.

The fundamental question is whether continued business-initiated efforts will do the job, or whether additional Government regulation is required.

A current financial issue is whether some services provided by public accountants are incompatible with the primary audit function and thus compromise audit firm independence.

The AICPA's independent Commission on Auditors' Responsibilities concluded, based on its research, that the facts did not justify a restriction of such services but that management should report on their nature in general response to questions raised by those concerned. Subsequently, the Securities and Exchange Commission issued regulations requiring such disclosure in 1979 proxy statements.

As discussed elsewhere in this Report, the Audit Committee of the GE Board of Directors reviews with the independent public accountants the scope of regular audit work as well as the type and extent of their "non-audit" services performed for General Electric. In 1978, these services consisted of such items as tax return preparation and consultation, reviews and development of computer systems, audits of employee benefit plan trusts, and acquisition reviews. The Audit Committee determined that performance of these services could not reasonably have affected the independence of Peat, Marwick, Mitchell & Co.'s regular audit work for GE.

In our view, concern about the impact of "non-audit" services on auditor independence is exaggerated. However, since the credibility of auditors is vital to investor confidence, we hope the information now being provided by public companies, coupled with board of director review, will work to lay this issue to rest.

With respect to financial reporting by public companies, we believe that considerable progress is being made. At General Electric, we continue to stress a strong system of internal financial controls, as discussed in the Report of Management on the opposite page, and timely reporting of financial results and information essential to informed decision-making by investors. Responsible financial reporting is a shared interest among those having a stake in the progress of your Company. We intend to remain at the forefront of high-quality financial reporting.

We also believe that the responsibility for establishing standards of financial accounting and reporting should be kept in the private sector. GE management vigorously supports the Financial Accounting Standards Board and its procedures, which we feel contribute significantly to even-handed accounting and reporting standards.

Regulation of the private sector by Government in the U.S. has been accelerating at an alarming pace. Conservative estimates by the Center for the Study of American Business at Washington University put private sector costs to comply with Federal regulations at about $98 billion for fiscal 1979. Added to that is another $4.8 billion to operate the regulatory agencies themselves. These combined costs increased 58% since 1976.

There are serious questions about the ability of U.S. business to underwrite, as rapidly as is being required, the increasing levels of resources committed to complying with Government regulations. The pressure of these expenditures on a pervasive inflation rate, combined with their negative impact on badly needed productivity improvements, are legitimate concerns.

General Electric management will continue to represent these concerns while participating in the regulatory rule-making process.

Capital formation and the related impacts of inflation and tax policy have been commented on in the Company's previous Annual Reports. The issues are worth repeating.

For the individual taxpayer, inflation boosts earnings into higher tax brackets, reduces or eats into savings, and increases the costs of most goods and services. For the corporation, the impact is much the same. As a result, *real* earnings are often much lower than reported by conventional accounting procedures, and the *real* return on investment falls below levels needed to provide adequate capital for business growth and jobs.

Accounting procedures are being developed to help measure the impact of inflation. However, existing tax policy on depreciation of plant and equipment does not adequately address the economic consequences of inflation on capital formation.

In General Electric's case, the hidden impact of inflation is reduced by use of LIFO accounting for approximately 80% of inventories. For plant and equipment no similar tax allowable practice is permitted. Using the Securities and Exchange Commission's replacement cost approach, depreciation expense for your Company in 1978 would have been about $310 million greater than amounts reflected in reported financial results, compared with $290 million for 1977. In general, funds necessary to replace these shortfalls must come entirely from after-tax profits or from the infusion of capital. General Electric spent $1,055 million for plant and equipment additions in 1978, some 28% more than a year earlier. The Company's resource allocation procedures take into account the need to maximize the *real* return on these expenditures.

The tax burden of your Company, including affiliates, amounted in 1978 to over $1.4 billion, consisting of payments and accruals for Federal, state, local and foreign income taxes; Social Security taxes; other taxes such as those on property; and certain export duties. In the aggregate, this tax cost equaled 7.3% of net sales billed, somewhat higher than Company after-tax earnings of 6.3%.

Taxes are also paid by our employees on salaries and wages, share owners on dividends, suppliers of materials and services utilized in Company operations, and, in many cases, by customers on their purchase and use of Company products. The magnitude of the total of these taxes shows the significant contribution the Company and its principal constituencies make to the funding of Government.

Taxes today do far more than pay for the cost of Government. They affect the whole base of the economy. Because of this critical impact, all citizens should remain informed about taxation and the expenditure programs of Government and make their views known.

Report of management

To the Share Owners of
General Electric Company

We have prepared the accompanying statement of financial position of General Electric Company and consolidated affiliates as of December 31, 1978 and 1977, and the related statements of earnings, changes in financial position and changes in share owners' equity for the years then ended, including the notes and industry and geographic segment information. The statements have been prepared in conformity with generally accepted accounting principles appropriate in the circumstances, and include amounts that are based on our best estimates and judgments. Financial information elsewhere in this Annual Report is consistent with that in the financial statements.

Your Company maintains a strong system of internal financial controls and procedures, supported by a corporate staff of traveling auditors and supplemented by resident auditors located around the world. This system is designed to provide reasonable assurance, at appropriate cost, that assets are safeguarded and that transactions are executed in accordance with management's authorization and recorded and reported properly. The system is time-tested, innovative and responsive to change. Perhaps the most important safeguard in this system for share owners is the fact that the Company has long emphasized the selection, training and development of professional financial managers to implement and oversee the proper application of its internal controls and the reporting of management's stewardship of corporate assets and maintenance of accounts in conformity with generally accepted accounting principles.

The independent public accountants provide an objective, independent review as to management's discharge of its responsibilities insofar as they relate to the fairness of reported operating results and financial condition. They obtain and maintain an understanding of GE's accounting and financial controls, and conduct such tests and related procedures as they deem necessary to arrive at an opinion on the fairness of financial statements.

The Audit Committee of the Board of Directors, composed solely of Directors from outside the Company, meets with the independent public accountants, management and internal auditors periodically to review the work of each and ensure that each is properly discharging its responsibilities. (See Audit Committee report on page 25.) The independent public accountants have free access to this Committee, without management present, to discuss the results of their audit work and their opinions on the adequacy of internal financial controls and the quality of financial reporting.

Your management has long recognized its responsibility for conducting the Company's affairs in a manner which is responsive to the ever-increasing complexity of society. This responsibility is reflected in key Company policy statements regarding, among other things, potentially conflicting outside business interests of Company employees, proper conduct of domestic and international business activities, and compliance with antitrust laws. Educational, communication and review programs are designed to ensure that these policies are clearly understood and that there is awareness that deviation from them will not be tolerated.

Reginald H. Jones
Chairman of the Board
and Chief Executive Officer

Senior Vice President, Finance
February 16, 1979

Report of independent certified public accountants

To the Share Owners and Board of Directors of
General Electric Company

We have examined the statement of financial position of General Electric Company and consolidated affiliates as of December 31, 1978 and 1977, and the related statements of earnings, changes in financial position and changes in share owners' equity for the years then ended. Our examinations were made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the aforementioned financial statements present fairly the financial position of General Electric Company and consolidated affiliates at December 31, 1978 and 1977, and the results of their operations and the changes in their financial position for the years then ended, in conformity with generally accepted accounting principles applied on a consistent basis.

Peat, Marwick, Mitchell & Co

Peat, Marwick, Mitchell & Co.
345 Park Avenue, New York, N.Y. 10022
February 16, 1979

Statement of earnings

General Electric Company and consolidated affiliates

For the years ended December 31 (In millions)	1978	1977	Additional information
Sales of products and services to customers	$19,653.8	$17,518.6	note 1
Operating costs			note 2
Employee compensation, including benefits	7,401.3	6,555.5	note 3
Materials, supplies, services and other costs	9,866.7	8,753.9	
Depreciation, depletion and amortization	576.4	522.1	
Taxes, except those on income	250.6	239.0	
Increase in inventories during the year	(399.1)	(249.9)	
	17,695.9	15,820.6	
Operating margin	1,957.9	1,698.0	
Other income	419.0	390.3	note 4
Interest and other financial charges	(224.4)	(199.5)	note 5
Earnings before income taxes and minority interest	2,152.5	1,888.8	
Provision for income taxes	(893.9)	(773.1)	note 6
Minority interest in earnings of consolidated affiliates	(28.9)	(27.5)	
Net earnings applicable to common stock	$ 1,229.7	$ 1,088.2	

Earnings per common share (in dollars)	$5.39	$4.79	note 7
Dividends declared per common share (in dollars)	$2.50	$2.10	
Operating margin as a percentage of sales	10.0%	9.7%	
Net earnings as a percentage of sales	6.3%	6.2%	

The information on pages 31 and 36-44 is an integral part of this statement.

Statement of financial position

General Electric Company and consolidated affiliates

At December 31 (In millions)	1978	1977	Additional information
Assets			
Cash	$ 1,992.8	$ 1,717.9	note 8
Marketable securities	470.3	560.3	note 8
Current receivables	3,288.5	2,982.7	note 9
Inventories	3,003.4	2,604.3	note 10
Current assets	8,755.0	7,865.2	
Property, plant and equipment	8,328.2	7,514.5	note 11
Accumulated depreciation, depletion and amortization	(4,305.6)	(3,930.4)	note 11
	4,022.6	3,584.1	note 11
Investments	1,410.5	1,433.3	note 12
Other assets	847.9	814.2	note 13
Total assets	$15,036.0	$13,696.8	
Liabilities and equity			
Short-term borrowings	$ 960.3	$ 772.1	note 14
Accounts payable	1,217.2	1,021.4	
Progress collections and price adjustments accrued	1,667.3	1,369.7	
Dividends payable	147.6	125.1	
Taxes accrued	532.6	619.9	
Other costs and expenses accrued	1,650.2	1,508.8	note 15
Current liabilities	6,175.2	5,417.0	
Long-term borrowings	993.8	1,284.3	note 16
Other liabilities	1,129.5	921.2	
Total liabilities	8,298.5	7,622.5	
Minority interest in equity of consolidated affiliates	150.8	131.4	
Preferred stock ($1 par value; 2,000,000 shares authorized; none issued)	—	—	
Common stock ($2.50 par value; 251,500,000 shares authorized; 231,463,949 shares issued 1978; 231,410,196 shares issued 1977)	578.7	578.5	
Amounts received for stock in excess of par value	658.0	668.4	
Retained earnings	5,522.4	4,862.5	
	6,759.1	6,109.4	
Deduct common stock held in treasury	(172.4)	(166.5)	
Total share owners' equity	6,586.7	5,942.9	notes 17 and 18
Total liabilities and equity	$15,036.0	$13,696.8	
Commitments and contingent liabilities			note 19

The information on pages 31 and 36-44 is an integral part of this statement.

Statement of changes in financial position

General Electric Company and consolidated affiliates

For the years ended December 31 (In millions)	1978	1977
Source of funds		
From operations		
Net earnings	$1,229.7	$1,088.2
Less earnings retained by nonconsolidated finance affiliates	(15.7)	(14.6)
Depreciation, depletion and amortization	576.4	522.1
Income tax timing differences	31.9	(73.4)
Minority interest in earnings of consolidated affiliates	28.9	27.5
	1,851.2	1,549.8
Increases in long-term borrowings	95.5	90.3
Newly issued common stock	2.6	54.1
Disposition of treasury shares	189.8	51.9
Increase in current payables other than short-term borrowings	570.0	651.1
Decrease in investments	22.8	—
Other — net	176.3	222.6
Total source of funds	2,908.2	2,619.8
Application of funds		
Additions to property, plant and equipment	1,055.1	822.5
Dividends declared on common stock	569.8	476.9
Increase in investments	—	147.0
Reduction in long-term borrowings	386.0	128.3
Purchase of treasury shares	195.7	25.9
Increase in current receivables	305.8	265.4
Increase in inventories	399.1	249.9
Total application of funds	2,911.5	2,115.9
Net change in cash, marketable securities, and short-term borrowings	$ (3.3)	$ 503.9
Analysis of net change in cash, marketable securities, and short-term borrowings		
Increase in cash and marketable securities	$ 184.9	$ 664.9
(Increase) in short-term borrowings	(188.2)	(161.0)
	$ (3.3)	$ 503.9

The information on pages 31 and 36-44 is an integral part of this statement.

Statement of changes in share owners' equity

General Electric Company and consolidated affiliates

For the years ended December 31 (Dollar amounts in millions)	1978	1977	1978	1977
Common stock issued			(Thousands of shares)	
Balance January 1	$ 578.5	$ 575.9	231,410	230,369
New shares issued:				
Stock options and appreciation rights	—	0.2	—	91
Employee savings plans	0.2	2.4	54	950
Balance December 31	578.7	578.5	231,464	231,410
Amounts received for stock in excess of par value				
Balance January 1	668.4	618.3		
Excess over par value of amounts received for newly issued shares	2.4	51.5		
Loss on disposition of treasury stock	(12.8)	(1.4)		
Balance December 31	658.0	668.4		
Retained earnings				
Balance January 1	4,862.5	4,251.2		
Net earnings	1,229.7	1,088.2		
Dividends declared on common stock	(569.8)	(476.9)		
Balance December 31	5,522.4	4,862.5		
Common stock held in treasury				
Balance January 1	(166.5)	(192.5)	(3,249)	(3,748)
Purchases	(195.7)	(25.9)	(3,838)	(491)
Dispositions:				
Employee savings plans	116.1	45.6	2,223	859
Incentive compensation plans	8.0	6.3	147	131
Stock options and appreciation rights	7.0	—	134	—
Business acquisitions	58.7	—	1,155	—
Balance December 31	(172.4)	(166.5)	(3,428)	(3,249)
Total share owners' equity December 31	$6,586.7	$5,942.9	228,036	228,161

The information on pages 31 and 36-44 is an integral part of this statement.

Summary of significant accounting policies

Basis of consolidation
The financial statements consolidate the accounts of the parent General Electric Company and those of all majority-owned and controlled companies ("affiliated companies"), except finance companies whose operations are not similar to those of the consolidated group. All significant items relating to transactions among the parent and affiliated companies are eliminated from the consolidated statements.

The nonconsolidated finance companies are included in the statement of financial position under investments and are valued at equity plus advances. In addition, companies in which GE and/or its consolidated affiliates own 20% to 50% of the voting stock ("associated companies") are included under investments, valued at the appropriate share of equity plus advances. After-tax earnings of nonconsolidated finance companies and associated companies are included in the statement of earnings under other income.

A nonconsolidated uranium mining company (see note 12) is also included under investments and is valued at cost.

Sales
The Company and its consolidated affiliates record a transaction as a sale only when title to products passes to the customer or when services are performed in accordance with contract terms.

Vacation expense
Most employees earn credits during the current year for vacations to be taken in the following year. The expense of this liability is accrued during the year vacations are earned rather than in the year vacations are taken.

Pensions
Investments of the General Electric Pension Trust, which funds the obligations of the General Electric Pension Plan, are carried at amortized cost plus programmed appreciation in the common stock portfolio. Recognition of programmed appreciation is carried out on a systematic basis which does not give undue weight to short-term market fluctuations. Programmed appreciation will not be recognized if average book value, calculated on a moving basis over a multiyear period, exceeds average market value.

The funding program for the Pension Trust uses 6% as the estimated rate of future income. This rate includes systematic recognition of appreciation in the common stock portfolio.

Unfunded prior service liabilities of the Trust are amortized over 20 years. Net actuarial gains and losses are amortized over 15 years.

Costs of a separate, supplementary pension plan, primarily affecting long-service professional and managerial employees, are not funded. Current service costs and amortization of prior service costs over a period of 20 years are being charged to Company operating costs currently.

Investment tax credit
The investment tax credit is recorded by the "deferral method." Under this method, the credit is amortized as a reduction of the provision for taxes over the lives of the facilities to which the credit applies, rather than being "flowed through" to income in the year the asset is acquired.

Inventories
Substantially all manufacturing inventories located in the United States are valued on a last-in first-out, or LIFO, basis. Manufacturing inventories outside the U.S. are generally valued on a first-in first-out, or FIFO, basis. Valuations are based on the cost of material, direct labor and manufacturing overhead, and do not exceed net realizable values. Certain indirect manufacturing expenses are charged directly to operating costs during the period incurred, rather than being inventoried.

Mining inventories, which include principally mined ore and coal, metal concentrates and mining supplies, are stated at the lower of average cost or market. The cost of mining inventories includes both direct and indirect costs consisting of labor, purchased supplies and services, and depreciation, depletion and amortization of property, plant and equipment.

Property, plant and equipment
Manufacturing plant and equipment includes the original cost of land, buildings and equipment less depreciation, which is the estimated cost consumed by wear and obsolescence. An accelerated depreciation method, based principally on a sum-of-the-years digits formula, is used to record depreciation of the original cost of manufacturing plant and equipment purchased and installed in the United States subsequent to 1960. Acquisitions prior to 1961, and most manufacturing plant and equipment located outside the United States, are depreciated on a straight-line basis. If manufacturing plant and equipment is subject to abnormal economic conditions or obsolescence, additional depreciation is provided. Expenditures for maintenance and repairs of manufacturing plant and equipment are charged to operations as incurred.

The cost of mining properties includes initial expenditures and cost of major rebuilding projects which substantially increase the useful lives of existing assets. The cost of mining properties is depreciated, depleted or amortized over the useful lives of the related assets by use of unit-of-production, straight-line, or declining-balance methods.

Mining exploration costs are expensed until it is determined that the development of a mineral deposit is likely to be economically feasible. After this determination is made, all costs related to further development, including financing costs of identifiable new borrowings associated with the development of new mining projects, are capitalized. Amortization of such costs begins upon commencement of production and is over ten years or the productive life of the property, whichever is less.

Oil and gas properties are accounted for by use of the full cost method.

Notes to financial statements

1. Sales

Approximately one-eighth of sales were to agencies of the U.S. Government, which is the Company's largest single customer. The principal source of these sales was the Technical Systems and Materials segment of the Company's business.

2. Operating costs

Operating costs as classified for reporting to the Securities and Exchange Commission are shown below.

(In millions)	1978	1977
Cost of goods sold	$14,411.3	$12,744.4
Selling, general and administrative expenses	3,284.6	3,076.2
	$17,695.9	$15,820.6

Supplemental details are as follows:

(In millions)	1978	1977
Maintenance and repairs	$671.5	$599.4
Company-funded research and development	520.8	409.2
Social Security taxes	397.0	335.0
Advertising	247.4	219.0
Rent	198.0	156.1
Mineral royalties and export duties	78.8	85.2

The 1977 amount shown above for Company-funded research and development reflects reclassification of amounts reported previously, based on extensive review to refine the distinction between expenditures primarily of an engineering modification and improvement nature and those of a research and development nature.

Foreign currency translation gains, after recognizing related income tax effects and minority interest share, were $12.1 million in 1978 and $7.2 million in 1977.

3. Employee benefits

General Electric and its affiliates have a number of pension plans, the total Company cost of which was $381.4 million in 1978 and $319.2 million in 1977. The most significant of these plans is the General Electric Pension Plan, in which substantially all employees in the U.S. are participating. Obligations of the Pension Plan are funded through the GE Pension Trust.

Earnings of the Trust, including the programmed recognition of appreciation, as a percentage of book value of the portfolio were 7.8% for 1978 and 7.4% for 1977.

Unfunded liabilities of the Trust were estimated to be $639 million at December 31, 1978, compared with $732 million at the end of 1977. Unfunded vested liabilities included in these amounts were $534 million and $596 million at December 31, 1978 and 1977, respectively. Estimated market value of Trust assets at the end of 1978 was $4,202 million and $3,734 million at the end of 1977.

Financial statements of the Pension Trust appear below.

General Electric Pension Trust

(In millions)	1978	1977
Operating statement		
Total assets at January 1	$3,818.7	$3,386.1
Company contributions	316.6	279.8
Employee contributions	83.3	67.9
	399.9	347.7
Dividends, interest and sundry income	234.9	191.8
Common stock appreciation:		
Realized	0.7	11.1
Accrued	75.9	57.1
Total programmed	76.6	68.2
Pensions paid	(201.2)	(175.1)
Total assets at December 31	$4,328.9	$3,818.7
Financial position — December 31		
U.S. Government obligations and guarantees	$ 103.5	$ 141.7
Corporate bonds, notes and mineral interests	356.0	322.5
Real estate and mortgages	770.0	735.8
Common stocks and convertibles	2,781.5	2,431.0
	4,011.0	3,631.0
Cash and short-term investments	240.2	141.0
Other assets — net	77.7	46.7
Total assets	$4,328.9	$3,818.7
Funded liabilities:		
Liability to pensioners	$1,638.7	$1,507.7
Liability for pensions to participants not yet retired	2,690.2	2,311.0
Total funded liabilities	$4,328.9	$3,818.7

Costs of the separate supplementary pension plan were $35.3 million in 1978 and $12.3 million in 1977. Unamortized liabilities for this supplementary plan were $243 million and $88 million at December 31, 1978 and 1977, respectively. Amendments to the supplementary pension plan effective January 1, 1978, and changes in Social Security benefits resulted in an increase in the unamortized liabilities of approximately $151 million.

Utah has separate pension plans which are substantially fully funded and the costs of which are included in the total Company costs reported above.

Incentive compensation plans were participated in by over 3,000 key employees. Amounts included in costs and expenses for incentive compensation were $47.8 million in 1978 and $44.4 million in 1977.

4. Other income

(In millions)	1978	1977
Net earnings of GE Credit Corporation	$ 77.3	$ 67.2
Income from:		
Marketable securities and bank deposits	140.4	88.2
Customer financing	48.6	46.5
Associated companies and nonconsolidated uranium mining affiliate	33.7	62.2
Royalty and technical agreements	44.3	49.5
Other investments:		
Interest	18.6	19.0
Dividends	10.5	10.7
Other sundry items	45.6	47.0
	$419.0	$390.3

Other sundry items include gains from sales of marketable equity securities of $6.5 million in 1978 and $22.3 million in 1977.

5. Interest and other financial charges

Amounts applicable to principal items of long-term borrowings were $98.0 million in 1978 and $94.4 million in 1977.

6. Provision for income taxes

(In millions)	1978	1977
U.S. Federal income taxes:		
Estimated amount payable	$590.4	$526.3
Effect of timing differences	(13.5)	(23.3)
Investment credit deferred — net	24.9	23.7
	601.8	526.7
Foreign income taxes:		
Estimated amount payable	221.1	272.1
Effect of timing differences	45.4	(50.1)
	266.5	222.0
Other (principally state and local income taxes)	25.6	24.4
	$893.9	$773.1

All U.S. Federal income tax returns have been closed through 1971.

Provision has been made for Federal income taxes to be paid on that portion of the undistributed earnings of affiliates and associated companies expected to be remitted to the parent company. Undistributed earnings intended to be reinvested indefinitely in affiliates and associated companies totaled $815 million at the end of 1978 and $650 million at the end of 1977.

Changes in estimated foreign income taxes payable and in the effect of timing differences result principally from increased foreign earnings and tax rates, and from recognizing in 1978 for tax payment purposes the results of transactions in Australia and Canada recorded for financial reporting purposes in other periods.

Investment credit amounted to $50.7 million in 1978, compared with $43.4 million in the prior year. In 1978, $25.8 million was added to net earnings, compared with $19.7 million in 1977. At the end of 1978, the amount still deferred and to be included in net earnings in future years was $162.0 million.

Effect of timing differences on U.S. Federal income taxes

(In millions) Increase (decrease) in provision for income taxes	1978	1977
Tax over book depreciation	$ 25.5	$ 19.0
Undistributed earnings of affiliates and associated companies	8.0	19.1
Margin on installment sales	(10.1)	(12.4)
Provision for warranties	(31.1)	(27.1)
Other — net	(5.8)	(21.9)
	$(13.5)	$(23.3)

The cumulative net effect of timing differences has resulted in a deferred-tax asset which is shown under other assets.

Reconciliation from statutory to effective income tax rates

	1978	1977
U.S. Federal statutory rate	48.0%	48.0%
Reduction in taxes resulting from:		
Consolidated affiliate earnings (including DISC) subject to aggregate effective tax rates generally less than 48%	(3.4)	(2.6)
Inclusion of earnings of the Credit Corporation in before-tax income on an "after-tax" basis	(1.7)	(1.8)
Investment credit	(1.2)	(1.1)
Income tax at capital gains rate	(0.6)	(0.7)
Other — net	0.4	(0.9)
Effective tax rate	41.5%	40.9%

7. Earnings per common share

Earnings per share are based on the average number of shares outstanding. Any dilution which would result from the potential exercise or conversion of such items as stock options or convertible debt outstanding is insignificant (less than 1% in 1978 and 1977).

8. Cash and marketable securities

Time deposits and certificates of deposit aggregated $1,746.8 million at December 31, 1978, and $1,537.1 million at December 31, 1977. Deposits restricted as to usage and withdrawal or used as partial compensation for short-term borrowing arrangements were not material.

Marketable securities (none of which are equity securities) are carried at the lower of amortized cost or market value. Carrying value was substantially the same as market value at year-end 1978 and 1977. Included at year-end 1978 were U.S. treasury obligations of $393.7 million ($371.4 million in 1977).

9. Current receivables

(In millions) December 31	1978	1977
Customers' accounts and notes	$2,922.3	$2,576.0
Associated companies	27.8	88.5
Nonconsolidated affiliates	2.8	1.6
Other	414.1	384.2
	3,367.0	3,050.3
Less allowance for losses	(78.5)	(67.6)
	$3,288.5	$2,982.7

10. Inventories

(In millions) December 31	1978	1977
Raw materials and work in process	$1,802.3	$1,629.0
Finished goods	943.0	808.9
Unbilled shipments	258.1	166.4
	$3,003.4	$2,604.3

About 80% of total inventories are in the United States.

If the FIFO method of inventory accounting had been used by the Company, inventories would have been $1,519.0 million higher than reported at December 31, 1978 ($1,294.9 million higher than reported at December 31, 1977).

11. Property, plant and equipment

(In millions)	1978	1977
Major classes at December 31:		
Manufacturing plant and equipment		
Land and improvements	$ 123.5	$ 121.0
Buildings, structures and related equipment	1,983.8	1,878.5
Machinery and equipment	4,737.0	4,305.4
Leasehold costs and manufacturing plant under construction	232.4	166.5
Mineral property, plant and equipment	1,251.5	1,043.1
	$8,328.2	$7,514.5
Cost at January 1	$7,514.5	$6,954.8
Additions	1,055.1	822.5
Dispositions	(241.4)	(262.8)
Cost at December 31	$8,328.2	$7,514.5
Accumulated depreciation, depletion and amortization		
Balance at January 1	$3,930.4	$3,598.4
Current-year provision	576.4	522.1
Dispositions	(191.1)	(174.0)
Other changes	(10.1)	(16.1)
Balance at December 31	$4,305.6	$3,930.4
Property, plant and equipment less depreciation, depletion and amortization at December 31	$4,022.6	$3,584.1

12. Investments

(In millions) December 31	1978	1977
Nonconsolidated finance affiliates	$ 683.6	$ 605.2
Nonconsolidated uranium mining affiliate	86.7	86.7
Miscellaneous investments (at cost):		
Government and government-guaranteed securities	241.4	269.3
Other	119.1	105.8
	360.5	375.1
Marketable equity securities:		
Honeywell Inc.	—	20.4
Other	37.4	37.7
	37.4	58.1
Associated companies	257.1	322.8
Less allowance for losses	(14.8)	(14.6)
	$1,410.5	$1,433.3

Condensed consolidated financial statements for the General Electric Credit Corporation (the principal nonconsolidated finance affiliate) are shown below. More detailed information is available in General Electric Credit Corporation's 1978 Annual Report, copies of which may be obtained by writing to: General Electric Credit Corporation, P.O. Box 8300, Stamford, Conn. 06904.

General Electric Credit Corporation
Financial position

(In millions) December 31	1978	1977
Cash and marketable securities	$ 367.5	$ 278.6
Receivables:		
Time sales and loans	5,898.7	4,914.8
Deferred income	(843.9)	(686.7)
	5,054.8	4,228.1
Investment in leases	1,031.7	922.1
Sundry receivables	78.1	67.0
Total receivables	6,164.6	5,217.2
Allowance for losses	(199.3)	(178.1)
Net receivables	5,965.3	5,039.1
Other assets	325.9	217.0
Total assets	$6,658.7	$5,534.7
Notes payable:		
Due within one year	$2,953.0	$2,345.1
Long-term — senior	1,571.1	1,382.8
— subordinated	325.5	325.5
Other liabilities	513.7	361.4
Total liabilities	5,363.3	4,414.8
Deferred income taxes	618.9	520.7
Capital stock	443.7	381.9
Additional paid-in capital	11.5	11.5
Retained earnings	221.3	205.8
Equity	676.5	599.2
Total liabilities, deferred income taxes and equity	$6,658.7	$5,534.7

Current and retained earnings

(In millions) For the year	1978	1977
Earned income	$ 813.6	$ 656.6
Expenses:		
Interest and discount	336.7	237.8
Operating and administrative	315.1	259.9
Provision for losses — receivables	56.4	76.1
— other assets	8.0	(2.0)
Provision for income taxes	20.1	17.6
	736.3	589.4
Net earnings	77.3	67.2
Less dividends	(61.8)	(53.5)
Retained earnings at January 1	205.8	192.1
Retained earnings at December 31	$ 221.3	$ 205.8

Advances to nonconsolidated finance affiliates aggregated $0.7 million at the end of 1978 and 1977.

Investment in the nonconsolidated uranium mining affiliate consists of investment in a wholly-owned affiliate (established in the course of obtaining a U.S. Department of Justice Business Advisory Clearance Procedure Letter in connection with the 1976 Utah merger) to which all uranium business of Utah has been transferred. All common stock of this affiliate has been placed in a voting trust controlled by independent voting trustees. Prior to the year 2000, General Electric and its

affiliates may not withdraw the common stock from the voting trust except for sale to unaffiliated third parties. Directors and officers of the affiliate may not be directors, officers, or employees of General Electric, Utah or of any of their affiliates. Uranium may not be sold by this affiliate, in any state or form, to, or at the direction of, General Electric or its affiliates.

All outstanding shares of preferred stock of the uranium affiliate are retained by Utah as an affiliate of General Electric. Payment of cumulative quarterly dividends out of legally available funds on this preferred stock is mandatory in amounts equal to 85% of the affiliate's net after-tax income for the previous quarter (without taking account of any deduction for exploration expense as defined). Utah, as holder of the preferred stock, must make loans with up to 10-year maturities when requested by the affiliate, provided that the aggregate amount of such loans does not at any time exceed preferred dividend payments for the immediately preceding two calendar years.

The estimated realizable value of miscellaneous investments at December 31, 1978, was $350 million ($370 million at December 31, 1977).

Marketable equity securities are valued at the lower of cost or market. Aggregate market value of marketable equity securities was $173 million and $129 million at year-end 1978 and 1977, respectively. At December 31, 1978, gross unrealized gains on marketable equity securities were $136 million.

Cost of the investment in Honeywell Inc. was the appraised fair value recorded on October 1, 1970, when the General Electric information systems equipment business was transferred to Honeywell Information Systems Inc.

At December 31, 1977, GE held 524,000 shares of Honeywell common stock. GE sold all of its remaining 524,000 shares of Honeywell common stock in 1978 and sold 1,460,000 shares in 1977. Average cost was used to determine the amount of realized gains entering into the determination of net income.

13. Other assets

(In millions) December 31	1978	1977
Long-term receivables	$286.6	$332.7
Deferred charges	128.7	78.5
Customer financing	101.7	80.9
Recoverable engineering costs on government contracts	98.9	65.1
Real estate development projects	79.0	75.0
Deferred income taxes	75.3	118.0
Licenses and other intangibles — net	40.9	33.1
Other	36.8	30.9
	$847.9	$814.2

Licenses and other intangibles acquired after October 1970 are being amortized over appropriate periods of time.

14. Short-term borrowings

The average balance of short-term borrowings, excluding the current portion of long-term borrowings, was $714.8 million during 1978 (calculated by averaging all month-end balances for the year) compared with an average balance of $663.5 million in 1977. The maximum balance included in these calculations was $747.6 million and $738.3 million at the end of August 1978 and November 1977, respectively. The average effective interest rate for the year 1978 was 14.3% and for 1977 was 13.2%. These average rates represent total short-term interest expense divided by the average balance outstanding. A summary of short-term borrowings and the applicable interest rates is shown below.

Short-term borrowings

(In millions) December 31	1978		1977	
	Amount	Average rate at Dec. 31	Amount	Average rate at Dec. 31
Parent notes with trust departments	$302.4	10.24%	$309.0	6.85%
Consolidated affiliate bank borrowings	362.4	20.58	308.0	22.23
Other, including current portion of long-term borrowings	295.5		155.1	
	$960.3		$772.1	

Parent borrowings are from U.S. sources. Borrowings of consolidated affiliated companies are primarily from foreign sources. Current portion of long-term borrowings for 1978 includes General Electric 6¼% Debentures ($125.0 million) due in July 1979, and Utah 7½% Guaranteed Notes ($20.0 million) due in March 1979. Other borrowings include amounts from nonconsolidated affiliates of $59.4 million in 1978 ($65.7 million in 1977).

Although the total unused credit available to the Company through banks and commercial credit markets is not readily quantifiable, informal credit lines in excess of $1 billion had been extended by approximately 100 U.S. banks at year end.

15. Other costs and expenses accrued

The balance at the end of 1978 included compensation and benefit costs accrued of $572.8 million and interest expense accrued of $35.2 million. At the end of 1977, compensation and benefit costs accrued were $532.7 million and interest expense accrued was $31.5 million.

16. Long-term borrowings

(In millions) Outstanding December 31	1978	1977	Due date	Sinking fund/ prepayment period
General Electric Company:				
6¼ % Debentures	$ —	$ 125.0	1979	None
5¾ % Notes	75.0	81.3	1991	1972-90
5.30% Debentures	100.9	113.3	1992	1973-91
7½ % Debentures	156.5	171.0	1996	1977-95
8½ % Debentures	300.0	300.0	2004	1985-03
Utah International Inc:				
7½ % Guaranteed Notes	—	20.0	1979	None
Notes with banks	22.7	104.4	1981	1978-81
Assoc. company note	—	29.1	1986	1981-86
8% Guaranteed Sinking Fund Debentures	17.8	19.2	1987	1977-87
7.6% Notes	36.0	40.0	1988	1974-88
Other	26.2	7.8		
General Electric Overseas Capital Corporation:				
4¼ % Bonds	26.9	29.8	1985	1976-84
4¼ % Debentures	50.0	50.0	1987	None
5½ % Sterling/Dollar Guaranteed Loan Stock	7.4	6.8	1993	None
Other	37.0	59.0		
All other	137.4	127.6		
	$993.8	$1,284.3		

The amounts shown in the preceding table are after deduction of the face value of securities held in treasury as shown below.

Face value of long-term borrowings in treasury

(In millions) December 31	1978	1977
General Electric Company:		
5.30% Debentures	$39.1	$36.7
7½ % Debentures	29.0	21.8
General Electric Overseas Capital Corporation:		
4¼ % Bonds	6.0	5.1

General Electric 5.30% Debentures having a face value of $10.0 million in 1978 and 1977, and a reacquired cost of $7.6 million in 1978 and 1977, and General Electric 7½ % Debentures having a face value of $7.3 million in 1978 and $7.2 million in 1977, and a reacquired cost of $6.6 million in 1978 and 1977, were retired in accordance with sinking fund provisions. General Electric 5¾ % Notes having a face value of $6.3 million ($6.2 million in 1977) were retired in accordance with prepayment provisions.

Utah International Inc. notes with banks are payable in varying installments to 1981 and were subject to average interest rates at year-end 1978 and 1977 of 8.4% and 7.7%, respectively.

Borrowings of General Electric Overseas Capital Corporation are unconditionally guaranteed by General Electric as to payment of principal, premium if any, and interest. This Corporation primarily assists in financing capital requirements of foreign companies in which General Electric has an equity interest, as well as financing certain customer purchases.

Borrowings include 4¼ % Guaranteed Debentures due in 1987, which are convertible until June 15, 1987, into General Electric common stock at $80.75 a share, and 5½ % Sterling/Dollar Guaranteed Loan Stock due in 1993 in the amount of £3.6 million ($7.4 million), convertible from October 1976 into GE common stock at $73.50 a share. During 1978, General Electric Overseas Capital Corporation 4¼ % Guaranteed Bonds having a face value of $1.9 million ($1.9 million in 1977) and a reacquired cost of $1.5 million ($1.4 million in 1977) were retired in accordance with sinking fund provisions.

All other long-term borrowings were largely by foreign and real estate development affiliates with various interest rates and maturities.

Long-term borrowing maturities during the next five years, including the portion classified as current, are $215.8 million in 1979, $80.0 million in 1980, $50.5 million in 1981, $45.9 million in 1982, and $44.0 million in 1983. These amounts are after deducting reacquired debentures held in treasury for sinking fund requirements.

17. Share owners' equity

Common stock held in treasury at December 31, 1978, included 1,629,911 shares for the deferred compensation provisions of incentive compensation plans (1,491,515 shares at December 31, 1977). These shares are carried at market value at the time of allotment, which amounted to $80.0 million and $73.2 million at December 31, 1978 and 1977, respectively. The liability is recorded under other liabilities. Other common stock in treasury, which is carried at cost, aggregrated 1,797,806 and 1,758,055 shares at December 31, 1978 and 1977, respectively. These shares are held for future corporate requirements, including distributions under employee savings plans, incentive compensation awards and possible conversion of General Electric Overseas Capital Corporation convertible indebtedness. The maximum number of shares required for conversions was 737,725 at December 31, 1978 and 1977. Corporate requirements of shares for benefit plans and conversions may be met either from unissued shares or from shares in treasury.

Retained earnings at year-end 1978 included approximately $232.4 million representing the excess of earnings of nonconsolidated affiliates over dividends received since their formation. In addition, retained earnings have been reduced by $4.0 million, which represents the change in equity in associated companies since acquisition. At the end of 1977, these amounts were increases of $216.7 million and $63.2 million, respectively.

18. Stock option plans and performance units

The plan approved by the share owners in 1978, and previous plans under which options remain outstanding, provide continuing incentives for more than 500 employees. Option price under these plans is the full market value of GE common stock on date of grant. Employees can only exercise options to the extent that installments have matured, normally annually, over a period of four years under the 1978 plan and nine years under prior plans.

The 1973 plan provided, and the 1978 plan provides, for granting stock appreciation rights to holders of options under

present and past plans which permit them to surrender exercisable options or a portion of an option in exchange for an amount equal to the excess of the market price of the common stock on the date the right is exercised over the option price. The Management Development and Compensation Committee (Committee) of the Board of Directors determines whether this amount will be distributed in GE shares, cash or both.

The 1978 plan provides for granting performance units as a means of awarding incentive remuneration to plan participants in lieu of options and stock appreciation rights. Performance units are granted for award periods not exceeding five calendar years with an achievable value fixed by the Committee at the date of grant which does not exceed 90% of the fair market value of GE common stock on that date. The Committee also sets principal and minimum targets to be achieved and determines the value actually assigned to performance units at the end of the award period in relation to the degree to which the principal target has been achieved. Failure to achieve the minimum target makes the performance unit valueless. Even if the targets are achieved, performance units will only be paid when, if, and to the extent the Committee determines to make payment. No performance units have been paid to date.

At the end of 1978, there were 3,561,026 shares available for the 1978 plan and 3,234,404 shares covered by outstanding options granted under prior plans, for a total of 6,795,430 shares. Of this total amount, 1,659,724 shares were subject to exercisable options, 2,429,129 shares were under options not yet exercisable, and 2,706,577 shares were available for granting options in the future. Appreciation rights relating to unexpired options for 1,652,494 and 1,151,190 shares were outstanding at December 31, 1978 and 1977, respectively. Performance units with a per-unit maximum achievable value of $28.00 relating on a one-to-one basis to unexpired options for 854,449 shares were outstanding at December 31, 1978. The number of shares available for granting options at the end of 1977 was 238,767. A summary of stock option transactions during the last two years is shown below.

Stock options

		Average per share	
	Shares subject to option	Option price	Market price
Balance at Jan. 1, 1977	2,982,102	$51.00	$55.63
Options granted	695,693	51.56	51.56
Options exercised	(91,572)	44.55	52.75
Options surrendered on exercise of appreciation rights	(51,950)	43.17	53.36
Options terminated	(145,340)	54.39	—
Balance at Dec. 31, 1977	3,388,933	51.26	49.75
Options granted	1,123,107	50.60	50.60
Options exercised	(132,921)	43.93	53.21
Options surrendered on exercise of appreciation rights	(71,325)	43.64	51.85
Options terminated	(218,941)	52.87	—
Balance at Dec. 31, 1978	4,088,853	51.37	47.13

19. Commitments and contingent liabilities

Lease commitments and contingent liabilities, consisting of guarantees, pending litigation, taxes and other claims, in the opinion of management, are not considered to be material in relation to the Company's financial position.

Unaudited notes to financial statements

A. Operations by quarter for 1978 and 1977 (unaudited)

(Dollar amounts in millions; per-share amounts in dollars)	First quarter	Second quarter	Third quarter	Fourth quarter
1978:				
Sales of products and services to customers	$4,443.4	$4,963.8	$4,842.9	$5,403.7
Operating margin	413.4	520.3	464.1	560.1
Net earnings	247.8	319.4	298.9	363.6
Net earnings per common share	1.09	1.40	1.31	1.59
1977:				
Sales of products and services to customers	$4,063.0	$4,383.3	$4,348.7	$4,723.6
Operating margin	356.7	420.1	440.8	480.4
Net earnings	215.4	271.9	268.5	332.4
Net earnings per common share	0.95	1.20	1.18	1.46

B. Estimated current replacement cost of certain assets and certain costs and expenses (unaudited)

In inflationary periods, the cost of replacing certain assets, such as plant and equipment and inventories, with equivalent productive capacity or goods is generally higher than the cost incurred when such assets were originally acquired. The Securities and Exchange Commission (SEC) requires that estimates be made of replacement costs for certain assets and the effect of the assumed replacement on certain costs and expenses. In accordance with the SEC's requirement, the Company has made such estimates and will include them in its "10-K Report" to be filed with that agency at the end of March 1979. For further information about the impact of inflation, see page 30 of this Report.

Industry segment information

(In millions)	Revenues — For the years ended December 31					
	Total revenues		Intersegment sales		External sales and other income	
	1978	1977	1978	1977	1978	1977
Consumer products and services	$ 4,787.8	$ 4,148.1	$ 188.6	$181.9	$ 4,599.2	$ 3,966.2
Net earnings of GE Credit Corp.	77.3	67.2	—	—	77.3	67.2
	4,865.1	4,215.3	188.6	181.9	4,676.5	4,033.4
Industrial products and components	4,123.8	3,698.1	468.5	431.5	3,655.3	3,266.6
Power systems	3,485.7	3,217.6	174.4	153.9	3,311.3	3,063.7
Technical systems and materials	4,744.6	4,144.6	189.0	148.0	4,555.6	3,996.6
Natural resources	1,032.2	965.1	—	—	1,032.2	965.1
Foreign multi-industry operations	2,767.3	2,562.1	55.3	49.4	2,712.0	2,512.7
General corporate items and eliminations	(945.9)	(893.9)	(1,075.8)	(964.7)	129.9	70.8
Total	$20,072.8	$17,908.9	$ —	$ —	$20,072.8	$17,908.9

	Segment operating profit — For the years ended December 31		Net earnings — For the years ended December 31	
	1978	1977	1978	1977
Consumer products and services	$ 573.3	$ 482.8	$ 300.2	$ 255.9
Net earnings of GE Credit Corp.	77.3	67.2	77.3	67.2
	650.6	550.0	377.5	323.1
Industrial products and components	426.3	366.7	222.5	191.1
Power systems	196.3	162.7	102.1	75.5
Technical systems and materials	545.3	473.7	277.8	247.5
Natural resources	371.5	389.2	180.1	196.2
Foreign multi-industry operations	244.9	210.8	77.4	70.6
Total segment operating profit	2,434.9	2,153.1		
General corporate items and eliminations	(58.0)	(64.8)	(7.7)	(15.8)
Interest and other financial charges	(224.4)	(199.5)	—	—
Total	$2,152.5	$1,888.8	$1,229.7	$1,088.2

	Assets — At December 31		Property, plant and equipment — For the years ended December 31			
			Additions		Depreciation, depletion & amortization	
	1978	1977	1978	1977	1978	1977
Consumer products and services	$ 2,018.5	$ 1,791.9	$ 169.0	$127.0	$104.2	$101.0
Investment in GE Credit Corp.	677.3	600.0	—	—	—	—
	2,695.8	2,391.9	169.0	127.0	104.2	101.0
Industrial products and components	2,125.1	1,925.1	165.6	147.7	91.1	83.8
Power systems	2,104.6	2,152.8	84.3	81.6	78.7	73.2
Technical systems and materials	2,682.7	2,128.3	289.2	203.8	149.6	126.3
Natural resources	1,489.3	1,386.0	212.5	131.6	77.5	66.9
Foreign multi-industry operations	2,099.6	1,849.0	118.9	115.9	63.8	52.7
General corporate items and eliminations	1,838.9	1,863.7	15.6	14.9	11.5	18.2
Total	$15,036.0	$13,696.8	$1,055.1	$822.5	$576.4	$522.1

Consumer products and services consists of major appliances (which also includes appliance service), air conditioning equipment, lighting products, housewares and audio products and services, television receivers and broadcasting and cablevision services.

General Electric Credit Corporation, a wholly-owned nonconsolidated finance affiliate, engages primarily in consumer, commercial and industrial financing, principally in the U.S. Products of companies other than General Electric constitute a major portion of products financed by GECC.

Industrial products and components includes components (appliance controls, small motors and electronic components); industrial capital equipment (construction, automation, and transportation); maintenance, inspection, repair and rebuilding of electric and mechanical apparatus; and a network of supply houses offering products of General Electric and other manufacturers.
Power systems includes steam turbine-generators, gas turbines, nuclear power reactors and nuclear fuel assemblies, transformers, switchgear, meters, and installation and maintenance engineering services.
Technical systems and materials consists of jet engines for aircraft, industrial and marine applications; electronic and other high-technology products and services primarily for space applications and national defense; materials (engineering plastics, silicones, industrial cutting materials, laminated and insulating materials, and batteries); medical and communications equipment; and time sharing, computing, and remote data processing.
Natural resources includes the mining of coking coal (principally in Australia), uranium, steam coal, iron, and copper. In addition, it includes oil and natural gas production, ocean shipping (primarily in support of mining operations) and land acquisition and development.
Foreign multi-industry operations consists principally of foreign affiliates who manufacture products primarily for sale in their respective home markets.

In general, it is GE's policy to price internal sales as nearly as practicable to equivalent commercial selling prices.

In computing net earnings, general corporate expenses and interest and other financial charges have been allocated to the industry segments. General corporate expenses are allocated principally on the basis of cost of operations, with certain exceptions and reductions which recognize the varying degrees to which affiliated companies maintain their own corporate structures. Interest and other financial charges are allocated to parent company components based principally on cash flow, and affiliated companies generally service their own debt. In addition, provision for income taxes ($893.9 million in 1978, $773.1 million in 1977) is allocated based on the total corporate effective tax rate, except for GECC and natural resources, whose income taxes are calculated separately. Minority interest ($28.9 million in 1978, $27.5 million in 1977) is allocated to operating components having responsibility for investments in consolidated affiliates.

Geographic segment information

(In millions)	Revenues For the years ended December 31					
	Total revenues		Intersegment sales		External sales and other income	
	1978	1977	1978	1977	1978	1977
United States	$16,443.1	$14,560.4	$362.6	$340.3	$16,080.5	$14,220.1
Far East including Australia	1,108.8	1,056.2	241.8	204.0	867.0	852.2
Other areas of the world	3,270.4	2,916.7	145.1	80.1	3,125.3	2,836.6
Elimination of intracompany transactions	(749.5)	(624.4)	(749.5)	(624.4)	—	—
Total	$20,072.8	$17,908.9	$ —	$ —	$20,072.8	$17,908.9

Included in United States revenues were export sales to unaffiliated customers of $2,570.7 million in 1978 and $2,101.2 million in 1977. Of such sales, $1,661.9 million in 1978 ($1,216.9 million in 1977) were to customers in Europe, Africa and the Middle East; and $498.1 million in 1978 ($574.2 million in 1977) were to customers in the Far East and Australia.

	Net earnings For the years ended December 31		Assets At December 31	
	1978	1977	1978	1977
United States	$ 960.6	$ 846.3	$11,410.4	$10,491.5
Far East including Australia	170.1	161.6	888.5	871.2
Other areas of the world	103.6	83.5	2,826.8	2,414.8
Elimination of intracompany transactions	(4.6)	(3.2)	(89.7)	(80.7)
Total	$1,229.7	$1,088.2	$15,036.0	$13,696.8

Revenues, net earnings and assets associated with foreign operations are shown in the tabulation above. At December 31, 1978, foreign operation liabilities, minority interest in equity and GE interest in equity were $1,909.4 million, $150.3 million and $1,655.6 million, respectively. On a comparable basis at December 31, 1977, foreign operation liabilities, minority interest in equity and GE interest in equity were $1,798.7 million, $131.3 million and $1,356.0 million, respectively.

Management's discussion and analysis of statement of earnings

General: The financial statements and related notes provide detailed information about operating results, financial position, changes therein, and industry and geographic segments for the years 1978 and 1977. Summary data for the last ten years are on pages 46 and 47.

Because of the diversity of the Company's business, comments about the relative impact of physical volume and selling prices on year-to-year changes in sales can only be generalized. However, it is estimated that greater volume accounted for about two-thirds of the increase of $2.1 billion or 12% in sales in 1978 from 1977. Sales for 1977 increased $1.8 billion (12%) from 1976, and it is estimated that somewhat more than half of the increase resulted from higher volume.

Other income from a variety of operating and nonoperating sources was $419.0 million, or 7% more in 1978 than 1977. Major sources of other income are shown in note 4 to the financial statements. From 1976 to 1977, other income increased $116.0 million, or 42%. Principal 1977 increases were from operations of associated companies and a nonconsolidated uranium mining affiliate and interest on a higher average level of marketable securities and bank deposits.

Operating costs are summarized in the table on pages 46 and 47. Principal elements of operating costs for 1978 and 1977 are in the statement of earnings on page 32. Continuing cost control, combined with higher sales, resulted in an increase in operating margin (sales less operating costs) in 1978 from 1977, and in 1977 from 1976. The ratio of operating margin to sales increased to 10.0% in 1978 from the 9.7% rate in 1977, which was the same as the 1976 rate.

Interest and other financial charges were 12% more in 1978 than 1977, due principally to a somewhat higher level of foreign borrowings in connection with overseas operations and somewhat higher domestic interest rates. The 1977 interest expense was up 14% from 1976, principally because of an increased level of offshore borrowings.

Provision for income taxes increased 16% in 1978 from 1977 because of higher taxable earnings after a 16% increase from 1976 for the same reason. The relationship of income tax provisions to income before taxes was 41.5% for 1978, 40.9% for 1977, and 41.1% for 1976.

Industry segment results: Financial data by industry segment for 1978 and 1977 are presented on pages 43 and 44. Detailed comments on 1978 results compared with 1977 are included on pages 6 through 21. Reference should be made to those comments, as well as to the summary of revenues and net earnings for the last five years which also is presented on pages 6 through 21. A résumé of significant items comparing 1978 with 1977, and 1977 with 1976, is included below.

Consumer products and services 1978 revenues and earnings, including GE Credit Corporation, were up 15% and 17%, respectively, with all major businesses contributing to the improvements, although major appliance margin rates were slightly lower as a result of the cost-price squeeze. Benefiting from generally strong markets in 1977, earnings that year were up 24% from 1976 on a 20% increase in revenues.

Industrial products and components revenues for 1978 were up 12% and earnings were up 17%. Businesses serving construction, locomotive, and appliance components markets were particularly strong. In 1977, earnings and sales were up 19% and 13%, respectively, from 1976, generally led by the same business components as in 1978.

Power systems businesses earnings in 1978 were 36% higher on an 8% revenue increase. Large steam turbine-generator and power delivery products principally accounted for the higher 1978 earnings. Earnings for 1977 were up 23% from the low level for 1976 on a 7% revenue increase. Gas turbine and power delivery products were principal contributors. As planned, the Company's nuclear business operated at a loss in 1978 as it had in the previous two years.

Technical systems and materials revenues and earnings were up 14% and 12%, respectively, in 1978, with engineered materials reporting substantially higher results and medical systems, information services, and communications businesses also having significant increases. Better aircraft engine earnings from higher 1978 sales were partially offset by the stepped-up level of commercial engine development expenditures. Earnings in 1977 increased 23% from 1976 on 12% higher revenues. All major business elements contributed to the increases.

Natural resources revenues were 7% higher in 1978 than in 1977, but earnings were down 8%. Australian coking coal shipments were about the same as for 1977, despite generally poor world steel markets. However, coking coal earnings were lower, principally because of a miners' strike of nearly seven weeks and higher Australian taxes. Canadian copper and U.S. petroleum operations reported improved results. Lower earnings from uranium operations and losses associated with the weak market for production from Brazilian iron ore operations were other factors contributing to the decrease in earnings. Revenues for 1977 were 4% below 1976, primarily because uranium operations were no longer consolidated, but earnings were up 8% despite general weakness in steel markets for Australian coking coal and severely depressed copper prices in 1977. "Spot" sales of coking coal largely offset reduced deliveries to Japanese steel mills, although spot prices were generally lower than long-term contract prices. The major positive factor was improved dividend income from the nonconsolidated uranium mining affiliate.

Foreign multi-industry earnings for 1978 were up 10% on 8% higher revenues, led by international construction operations and Latin American operations. Other affiliates generally reported improved results, with the exception of those in Italy which sustained a higher loss than in the previous year. Earnings also included a nonrecurring gain from sale of an investment in an associated company. Revenues in 1977 were up 10% from 1976, but earnings were down 5%, principally because of no counterpart to a nonrecurring gain on sale of an investment, the adverse impact of start-up costs associated with an appliance affiliate in Canada, and depressed economic conditions affecting consumer goods operations in a number of areas.

Ten-year summary (a)

(Dollar amounts in millions; per-share amounts in dollars)	1978	1977	1976	1975	1974
Summary of operations					
Sales of products and services to customers	$19,653.8	$17,518.6	$15,697.3	$14,105.1	$13,918.2
Materials, engineering and production costs	14,411.3	12,744.4	11,481.2	10,624.2	10,458.1
Selling, general and administrative expenses	3,284.6	3,076.2	2,688.2	2,294.3	2,289.4
Operating costs	17,695.9	15,820.6	14,169.4	12,918.5	12,747.5
Operating margin	1,957.9	1,698.0	1,527.9	1,186.6	1,170.7
Other income	419.0	390.3	274.3	174.2	206.7
Interest and other financial charges	(224.4)	(199.5)	(174.7)	(186.8)	(196.5)
Earnings before income taxes and minority interest	2,152.5	1,888.8	1,627.5	1,174.0	1,180.9
Provision for income taxes	(893.9)	(773.1)	(668.6)	(459.8)	(457.4)
Minority interest	(28.9)	(27.5)	(28.3)	(25.7)	(18.2)
Net earnings	$ 1,229.7	$ 1,088.2	$ 930.6	$ 688.5	$ 705.3
Earnings per common share (b)	$ 5.39	$ 4.79	$ 4.12	$ 3.07	$ 3.16
Dividends declared per common share (c)	$ 2.50	$ 2.10	$ 1.70	$ 1.60	$ 1.60
Earnings as a percentage of sales	6.3%	6.2%	5.9%	4.9%	5.1%
Earned on average share owners' equity	19.6%	19.4%	18.9%	15.7%	17.8%
Dividends–General Electric	$ 569.8	$ 476.9	$ 332.5	$ 293.1	$ 291.2
Dividends–Utah International Inc. (d)	—	—	$ 28.3	$ 33.1	$ 23.9
Shares outstanding–average (in thousands) (e)	227,985	227,154	225,791	224,262	222,921
Share owner accounts–average	552,000	553,000	566,000	582,000	566,000
Market price range per share (c) (f)	57⅝-43⅝	57¼-47⅜	59¼-46	52⅞-32⅜	65-30
Price/earnings ratio range (c)	11-8	12-10	14-11	17-10	19-9
Current assets	$ 8,755.0	$ 7,865.2	$ 6,685.0	$ 5,750.4	$ 5,334.4
Current liabilities	6,175.2	5,417.0	4,604.9	4,163.0	4,032.4
Working capital	$ 2,579.8	$ 2,448.2	$ 2,080.1	$ 1,587.4	$ 1,302.0
Short-term borrowings	$ 960.3	$ 772.1	$ 611.1	$ 667.2	$ 655.9
Long-term borrowings	993.8	1,284.3	1,322.3	1,239.5	1,402.9
Minority interest in equity of consolidated affiliates	150.8	131.4	119.0	104.6	86.4
Share owners' equity	6,586.7	5,942.9	5,252.9	4,617.0	4,172.2
Total capital invested	$ 8,691.6	$ 8,130.7	$ 7,305.3	$ 6,628.3	$ 6,317.4
Earned on average total capital invested	16.3%	15.8%	15.1%	12.5%	13.4%
Property, plant and equipment additions	$ 1,055.1	$ 822.5	$ 740.4	$ 588.2	$ 812.9
Depreciation, depletion and amortization	576.4	522.1	486.2	470.5	415.0
Employees–average worldwide	401,000	384,000	380,000	380,000	409,000

(a) Unless specifically noted, all years are adjusted to include Utah International Inc., which became a wholly-owned affiliate of General Electric on December 20, 1976, through the exchange of 41,002,034 shares of General Electric common stock for all of the outstanding shares of Utah.
(b) Computed using outstanding shares as described in note (e).
(c) For General Electric common stock as reported in the years shown.
(d) Reflects transactions prior to merger date.
(e) Includes General Electric average shares outstanding plus, in 1976 and prior years, outstanding average shares previously reported by Utah multiplied by 1.3. Adjustments have been made for a two-for-one GE stock split in 1971 and the two-for-one and three-for-one Utah stock splits effected in the form of stock dividends in 1973 and 1969, respectively.
(f) Represents high and low market prices as reported on New York Stock Exchange through January 23, 1976, and as reported on the Consolidated Tape thereafter.

1973	1972	1971	1970	1969
$11,944.6	$10,473.7	$9,556.7	$8,833.8	$8,526.4
8,762.8	7,676.3	7,053.4	6,491.3	6,399.2
2,112.1	1,920.8	1,731.3	1,758.7	1,619.5
10,874.9	9,597.1	8,784.7	8,250.0	8,018.7
1,069.7	876.6	772.0	583.8	507.7
202.9	207.3	176.6	127.7	120.0
(142.8)	(120.8)	(102.1)	(105.5)	(83.8)
1,129.8	963.1	846.5	606.0	543.9
(456.5)	(385.5)	(332.8)	(237.2)	(240.8)
(11.9)	(5.0)	(4.2)	(5.8)	2.3
$ 661.4	$ 572.6	$ 509.5	$ 363.0	$ 305.4
$ 2.97	$ 2.57	$ 2.30	$ 1.66	$ 1.41
$ 1.50	$ 1.40	$ 1.38	$ 1.30	$ 1.30
5.5%	5.5%	5.3%	4.1%	3.6%
18.4%	17.5%	17.2%	13.4%	11.8%
$ 272.9	$ 254.8	$ 249.7	$ 235.4	$ 235.2
$ 14.0	$ 12.8	$ 11.4	$ 8.9	$ 7.6
222,631	222,503	221,591	218,938	217,048
543,000	542,000	529,000	535,000	525,000
75⅞-55	73-58¼	66½-46½	47¼-30⅛	49⅛-37
24-17	25-20	26-18	26-17	32-24
$ 4,597.4	$ 4,056.8	$3,700.0	$3,383.1	$3,362.6
3,588.2	2,920.8	2,893.8	2,689.4	2,398.2
$ 1,009.2	$ 1,136.0	$ 806.2	$ 693.7	$ 964.4
$ 675.6	$ 453.3	$ 581.7	$ 670.2	$ 351.5
1,166.2	1,191.2	1,016.2	691.3	813.6
62.4	53.4	50.4	45.0	42.3
3,774.3	3,420.2	3,105.4	2,819.1	2,610.8
$ 5,678.5	$ 5,118.1	$4,753.7	$4,225.6	$3,818.2
13.7%	12.7%	12.3%	10.2%	8.8%
$ 734.6	$ 500.8	$ 710.8	$ 685.3	$ 567.3
371.9	343.7	289.5	348.1	365.0
392,000	373,000	366,000	398,000	412,000

Supplemental information

Dividends declared
(Cents per share)

	1978	1977
First quarter	55¢	45¢
Second quarter	65	55
Third quarter	65	55
Fourth quarter	65	55

General Electric common stock market prices
(High and low by quarter)

	1978		1977	
First quarter	$49⅝	$43⅝	$55⅞	$49
Second quarter	54⅞	45⅞	57¼	47⅞
Third quarter	57⅝	49⅞	56½	50⅜
Fourth quarter	53⅞	45¾	52¾	47⅜

Form 10-K and other supplemental information
The information in the financial statements in this Report, in the opinion of management, substantially conforms with or exceeds the information required in the annual statements constituting part of the "10-K Report" submitted to the Securities and Exchange Commission, except for current replacement cost data. Certain supplemental information, considered nonsubstantive, is included in that report, however, and copies will be available without charge from: Investor Relations, General Electric Company, Fairfield, Connecticut 06431.

Copies of the General Electric Pension Plan, the Summary Annual Report for GE employee benefit plans subject to the Employee Retirement Income Security Act of 1974, and other GE employee benefit plan documents and information are available by writing to Investor Relations and specifying the information desired.

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Annual Report Issue

General Electric Company
Fairfield, Connecticut 06431

More for less: GE's more efficient lighting systems save customers money, conserve energy and provide better illumination. Shown: Northern Arizona U's recreation facility, where Lucalox® lamps increase the light yet reduce energy costs; experimental "sun house" that uses fluorescent lamps to cut lighting costs 63%; GE energy-and-cost-saving lighting for offices and schools.